# MSX
# and the Coming Revolution in Consumer Electronics

**MODERN ECONOMICS CO.**
Robert Chapman Wood, President
19 Otis Rd., Scituate, MA 02066
Tel. (617) 545-5938

# MSX
# AND THE COMING
# REVOLUTION IN
# CONSUMER ELECTRONICS

Modern Economics Co.
Robert Chapman Wood, President
19 Otis Rd.
Scituate, MA, 02066
Tel. (617) 545-5938
Telex 247-316 (ARTF UR) ATTN RW / DELPHI - RWOOD

October, 1984

Version 1.1
February, 1985

Modern Economics Co.
19 Otis Rd.
Scituate, MA, 02066

Tel. (617) 545-5938
Telex 247-316 (ARTF UR) ATTN RW / DELPHI - RW00D

Table of Contents

# MSX
# AND THE COMING REVOLUTION
# IN CONSUMER ELECTRONICS

## 0.1 INTRODUCTION AND SUMMARY

The MSX standard and related programs seem likely to achieve the same kind of affect on middle-to-upper class homes that the IBM PC standard is having in offices: They will permit state-of-the-art mass production and mass marketing of home computer-related devices for the first time and enable the computer to cause dramatic changes in lifestyles. In the long run the changes brought by the MSX standard in the home are likely to be even more important than the changes brought by the IBM standard in the office: home life is central to all human life.

Japan's major companies are famous for their slow, methodical approaches to business, much as IBM is famous for slow, methodical approaches. They may continue to move cautiously in

promoting the MSX standard, especially outside Japan. But the potential of projects now planned in Japan is so great -- and so much more far-sighted than anything being persued by home computer companies in the U.S. -- that there's every reason to expect MSX computers or their successors to be as common in 10 or 20 years as telephones are today. Among the MSX-based projects currently under discussion in Japan are:

- Complete, communicating computers so cheap that they can be built into televisions, video tape recorders, telephones, and other appliances.

- A $900 computer system with the power and memory capacity of an expensive hard-disk office machine.

- A musical computer that the consumer buys instead of a home organ.

- A "home bus" networking system which would carry electric current, local area computer networking, voice communication, and two-way television throughout homes, replacing electric and phone outlets.

- A worldwide Information Network System (INS) sponsored by the Nippon Telephone and Telegraph Corp. that will tie all devices in the home to all information providers in Japan -- and probably in other countries as well -- for a price no

higher than the price of a local telephone call today.

In the short-run (the next two years or so), the Commodore 64/128, the Apple II series, the IBM PC/PC Jr. series, and possibly the XE series of computers from Atari Corp. will offer tough competition for MSX in the U.S. market. These are mature product lines whose software is widely available. But the limitations of the 6502 microprocessor which runs the Commodore, Apple, and Atari machines suggest these products' capabilities cannot expand much beyond their current functions as primarily game machines and homework helpers. The IBM series may be an important group of products for the foreseeable future, but its layout suggests that it will never be competitive in price with MSX computers. On the other hand, MSX computers can do everything that an IBM PC or PC Jr. can do, and (with a 5 1/4 inch drive) are data compatible with the PC.

Most important, Commodore, Apple, and IBM all lack the superior consumer appliance manufacturing ability of the Japanese and Korean MSX supporters, and Apple and IBM, at least, are reluctant to let lower-cost foreign competitors build compatible machines for the home market. It seems highly unlikely that Commodore, Apple, or IBM-compatible computers will be built in large numbers into the televisions, laser-disk players, musical instruments, stereo systems, kitchen appliances, and video recorders of tomorrow.

Thus the appliances of the future will contain computers descended from the MSX computers of today. Though statements today about the role of the microcomputer in the homes of the late 80s are inevitably as speculative as late 1970s statements about the role of the microcomputer in the office of 1984, two points are certain: Those who say the computer will find no function in the average home are almost certainly wrong, and MSX manufacturers are perfectly positioned to provide the genuinely functional computers which homeowners will bring into their lives.

# Chapter 1

# THE MSX STANDARD

> "In home computers today, the market is not healthy. We believe that technology comes from industrial users down to the home users. The VTR came from the TV station to the home user. The Microwave oven came from the fast food stores to the home users. But the current low-end computers are not descended from the mainframes but from computer games. The home computers on the market are not from the top brands but from toy companies. We believe that in the future the power of the office computer will be available in the home. At that time the consumer will find real value in home computers, and Matsushita will supply them."
> -- Ken Shimba, spokesman for Matsushita Electric

MSX is much more than just an operating system. It is a thorough-going attempt to address all the issues of computer compatibility and capability in the home: to provide hardware standards which will permit the construction of very cheap computers which are fully expandable into and compatible with extremely powerful machines, and which connect with a household-wide and ultimately worldwide grid of other devices.

The basic MSX system components give the MSX a significant power advantage over today's home computers from Apple, Atari, and Commodore, but not so great an advantage as to be decisive if it were the MSX' only strength. The key components as of the first half of 1985 are a Z-80A microprocessor (essentially the same microprocessor that powers CP/M 80 and Coleco computers), a Texas Instruments TMS 9918A video chip, a General Instruments AY-3-8910 sound chip, an 8255 programmable peripheral interface, and 32K of ROM which contains an exceptionally powerful version of Microsoft BASIC -- extremely similar to, but slightly more powerful than, the BASIC in the IBM PC. The Z80A in the MSX runs three and a half times as fast as the 6502 processor that powers most home computers today and slightly slower than the 8088 chip that powers the IBM PC. The comparison is inexact, however. The

old 6502 processor handles straightforward applications more quickly than its clock speed might suggest, but its interrupt system is difficult to program, making it inappropriate for future home applications that would involve any form of multi-tasking.

Graphics and sound from the MSX' other chips also compare favorably with those of standard home computers today. The microprocessor and video chip are the same as those in Colecovision.

A significant upgrade of MSX, concentrating on its video capabilities, is expected on the market around the middle of this year. It will give the computer video capabilities to display 256 colors and 80 columns of text. With the TI 9918A video display processor MSX has 256 by 192 pixel screen resolution and can display 16 colors and 40 characters per line in text mode. This is highly competitive with other color displays widely sold today, including those of the Commodore 64 and IBM PC Jr. But it doesn't allow subtle color shadings or sophisticated word processing without additional hardware. The MSX group plans to include a new video chip in its next version designed by Yamaha, Microsoft, and ASCII Corp. The chip is said to produce 256 colors and 512 x 296 pixel screen resolution. Original MSX computers had 16K of dedicated video RAM; the new version is expected to have 64K, allowing the computer to manage its display quickly without slowing down other functions. The new MSX version will give the computer full word processing capability and graphics capabilities comparable to -- though perhaps not quite equal to -- those of the new Atari SE series and the Commodore Amiga. In addition, the new MSX chip is said to have built-in ability to handle the NAPLS videotext protocol.

MSX is often called an 8-bit computer, but that's extremely misleading. MSX is an 8-bit computer to roughly the same extent that the IBM PC is an 8-bit computer, and the IBM is usually called a 16-bit machine. The 8088 microprocessor, which powers the IBM PC, is an 8-bit chip in communications with the outside world. Its speed is determined by its communications through its 8-bit data bus. But it can be called a 16-bit chip because it handles data 16 bits at a time internally, accepts 16-bit instructions, and most importantly, addresses 16-bit memory locations. When the IBM PC was introduced its 8088 chip was clearly superior to the Z80 because of its memory-address capability. But since then Z80 computer designers have learned to build bank-switching systems into their computers to duplicate this ability. MSX computers will be built with the Z80 chip and bank-switching circuits in the same VLSI, thus making it fully competitive in power with the 8088 and the IBM PC.

But just as MSX is more than an operating system, it is also more than just a prescription of a few chips. Perhaps its most important component is its slot management system. All MSX computers will have at least one and as many as 15 slots into which software, memory expansion modules, and peripheral devices ranging from hard disks to electronic organs can be plugged. MSX architecture divides the 1,048,000 memory locations which the bank-switching address bus can address into four "slots" each of which can in turn be expanded with four secondary slots for a total of 16. One of these "slots" is necessarily occupied by the computer's built-in RAM and its 32K of built-in read-only memory, leaving 15 slots which can accept external add-ons.

The slot management system is designed to operate so that the user can plug whatever device he chooses into any slot and the computer will recognize it and put it to use. While this means the computer can support a megabyte (1 million-plus bytes) of RAM -- about 60% more than the IBM PC supports -- it also means that in practice it might be difficult for the computer to support that much RAM and still address peripheral devices, since peripheral devices normally occupy a slot which some of the RAM would have to occupy. Experienced MSX programers say, however, that today's MSX machines could easily be programed in applications requiring up to 896K of random access memory. RAM cartridges that would permit MSX computers to be expanded this way are on the market in Japan, but no software has yet been designed to handle this power.

The Japanese companies participating in the MSX group are working out all details of interfaces together through ASCII Corp., the Japanese microcomputer software company which is Japan's largest, and which is Microsoft Corp.'s Japanese agent. (Microsoft Far East Headquarters is a wholly owned subsidiary of ASCII Corp.) These details take time, but unless they are carefully handled no computer can fulfill the vast potential of the computer in the home.

On one hand, the MSX avoids the radically cheap shortcuts that Commodore and Atari have used to keep the basic prices of their machines down. For example, Commodore 64/128 and Atari XE series machines communicate with disk drives through a specially designed, cheap-to-manufacture serial port, rather than the high-speed parallel interface used in office computers. This makes the computer itself cheaper to manufacture, but it makes the disk drive slower and more expensive to produce reliably. MSX machines use exactly the same kind of disk drives as machines already in offices.

The disk operating system MSX-DOS is designed to be as similar as possible to MS-DOS and CP/M 80, the operating systems

respectively of the IBM PC and the largest number of already installed Z80-based computers. MSX-DOS is supposed to run most CP/M 80 programs off-the shelf without modification. And it will permit exchange of data disks with an IBM PC.

These capabilities are possible because CP/M doesn't prescribe any disk format. (Most manufacturers of CP/M computers use different, incompatible formats for their disks.) MS-DOS, the operating system Microsoft supplied for the IBM Personal Computer and compatibles, on the other hand, prescribes specific disk formats which have become industry standards. It's possible to format a disk as if it were for MS-DOS and load CP/M onto it.

Microsoft engineers sought to create an operating system that would respond to all CP/M commands and yet support all MSX functions. They may not have succeeded completely, and the process has taken a great deal of time. Such programs as the CP/M version of DBase II did not run under early versions of MSX-DOS without modification. Now, a year and a half after ASCII/Microsoft began promising MSX-DOS to the press, Microsoft officials say most compatibility problems have been resolved. However, MSX-DOS has yet to be delivered to commercial users in large numbers and the versions used at the Winter Consumer Electronics Show in the U.S. were labeled preliminary. MSX-DOS designers appear to have succeeded well enough to guarantee that MSX computers will be able to access one of the largest software bases of any new computer architecture ever. But MSX-DOS could still be a source of delays and embarrassments to the MSX group.

In addition, because MSX uses components similar to those in ColecoVision, ColecoVision games can be converted to MSX format with little modification. Because MSX BASIC is so similar to IBM PC BASIC, some IBM BASIC programs can run on MSX and most require trivial changes.

On the other hand, the MSX standard contains several elements which guarantee that MSX computers will be significantly cheaper to manufacture than IBM-compatible computers. First, because IBM has made the Intel 8080-series the industry standard for business computers, Intel has been able to keep the prices of the 8088 chip which powers the IBM PC far above the cost of manufacture. A currently quoted price of the 8088 is $15, while the Japanese will probably be able to produce a VLSI including a Z80, AY-3-8910-compatible sound circuitry, and bank switching functions to sell for $2 or so. Second, the MSX standard requires a much smaller power supply than the IBM PC standard. In addition, a number of other items have been designed into MSX for home needs rather than business needs: The MSX supports a smaller number of keys, for instance. Steven Ting, a Chinese-American engineer who was one of the major designers of

the MSX, estimates its manufacturing cost should be approximately half that of even a stripped-down IBM or compatible computer.

Standardization is important not only to provide software compatibility throughout the Japanese electronics industry, but equally important to encourage mass production. Early MSX computers contained approximately 40 integrated-circuit system chips. But because of the move to standardization, the Japanese electronics industry has been able to create VLSI chips to replace most of the original integrated circuits. Engineers say MSX computers based on the new chips will cut the number of chips in an MSX computer to approximately six.

It's assumed that the MSX standard will be continually upgraded while maintaining as much compatibility as possible with earlier versions of MSX. Beyond the video-oriented upgrade planned for mid-1985, a further upgrade which will involve a new microprocessor or processors is planned. Some OEMs, notably the European giant Philips, would like to see a true 16-bit coprocessor included at least as an option in MSX architecture during 1986. There is said to be a dispute between Microsoft U.S. and the Japanese over whether the new chip should be an Intel 8086-series chip (which would allow IBM compatibility and is favored by Microsoft U.S.) or a Motorola 68000 like the chip used in the Apple Macintosh and the Atari SE series (a chip more popular with programers but with a smaller existing software base). It's not clear whether this reported dispute really exists, however, or whether it is a delaying tactic on the part of Japanese who would prefer not to include any more American-designed chips in MSX. The MSX group clearly wants to include a Japanese-designed 16- or 32-bit chip in next generation machines which will retain the ability to emulate the Z-80 to run today's software.

Many aspects of the MSX standard remain incomplete, just as many aspects of the IBM standard remain incomplete to this day pending further IBM product announcements. The exact method of communication with a hard disk, for instance, has yet to be defined. The details of how MSX computers will eventually be networked together have yet to be worked out. (The Hong Kong company Spectravideo showed a low-cost MSX network at the Winter Consumer Electronics Show, but it should not be considered an MSX Group standard.) But the MSX group, like IBM and unlike such producers as Commodore, Apple, and Coleco doesn't claim that these questions can be settled quickly or easily. It only claims that it will address them in due time and that when it does, the consumer will be able to rely on products that conform to its decisions.

In short, MSX is positioned for the home much as the IBM PC

was positioned for the office three years ago: it is by no means "state-of-the-art," but it is a radical improvement over the machines most common in homes today. And it is a standard whose details either have been or are being very carefully worked out.

(the figures on the following page are reprinted courtesy of MSX World)

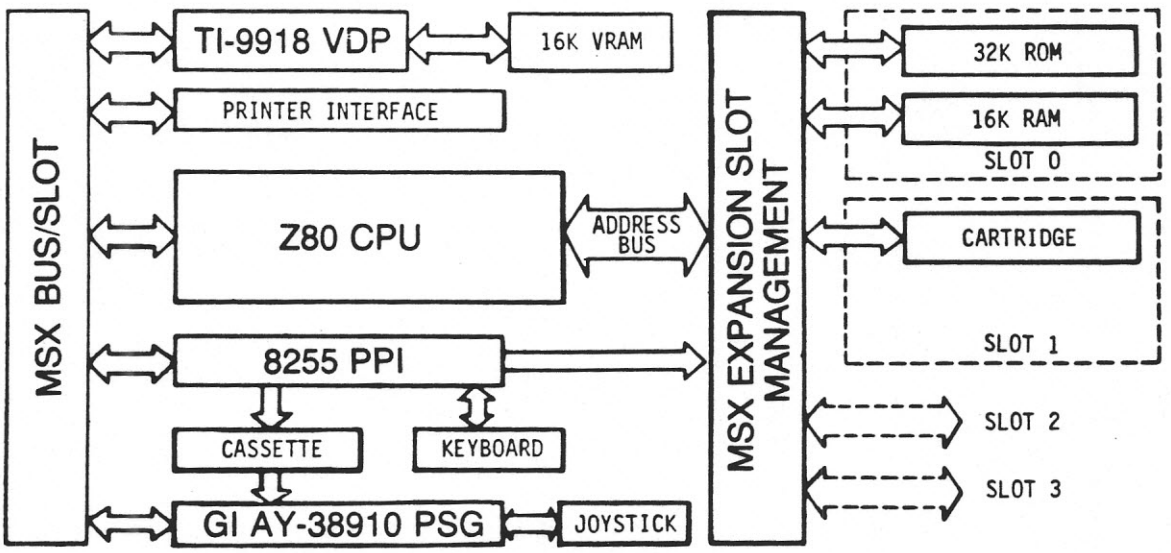
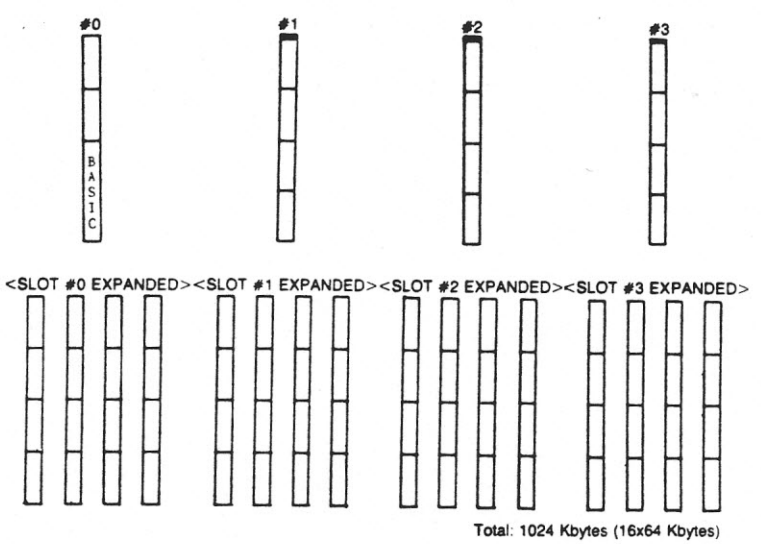



**Fig. 1 The minimum configuration of an MSX computer.**

**Fig. 2 Memory structure of MSX slot.**



# Chapter 2

## THE MSX MANUFACTURERS -- AND THE GROUP ORGANIZER

Companies working on products supporting the MSX standard in Japan (not all of whom are likely to invade the U.S. market right away) are:

- Casio, Ltd.
- Canon, Ltd.
- Fujitsu, Ltd.
- Hitachi, Ltd.
- Japan Victor Corp. (JVC)
- Kyocera, Ltd. (manufacturer of the Radio Shack Model 100 and other lap computers)
- Matsushita Electric Industrial Corp.
- Mitsubishi Electric, Ltd.
- Nippon Electric Corp. (NEC)
- Nihon Gakki, Ltd. (Yamaha)
- Nippon General Corp.
- Pioneer, Ltd.
- Sanyo Electric Corp.
- Sharp, Ltd.
- Sony Corp. and
- Toshiba Ltd.

All except NEC, Sharp, Casio, and Kyocera are currently

delivering MSX products in Japan.

Korean companies producing MSX computers are:

- Gold Star Ltd.,
- Samsung, Ltd., and
- and Daewoo Ltd.

European companies are Philips and its affiliate Grundig.

Spectravideo, the U.S. company whose Hong Kong-manufactured computer served as the basis of the original MSX standard, was recently taken over by its Hong Kong supplier, Bondwell Holdings Ltd. It hopes to supply MSX computers from Hong Kong after the major Japanese makers introduce them into various markets.

In addition, RCA Corp. and Zenith Corp. are known to be considering MSX products.

Of the companies on the lists, only NEC seems lukewarm about its MSX commitment. And NEC, the largest microcomputer manufacturer in Japan and the third largest in the world, seems not so much lukewarm as anxious to pursue several different tacks at once. On one hand, NEC has not formally committed itself to MSX and continues to promote its proprietary operating systems in the Japanese market. On the other hand, it continues working closely with the MSX group on development of MSX standards and has done nothing to deny MSX group statements that it is a member. NEC officials from outside the personal computer division say the company will support MSX.

## 2.1 ASCII Corp./Microsoft Far East: The MSX Group Organizer

MSX is the brainchild of Kazuhiko (Kaye) Nishi, the Japanese entrepreneur who is best known in the U.S. simply as a Japanese vice president of the software company Microsoft. But the Japanese company he helped found, ASCII Corp., is a microcomputer software power in its own right. It is Japan's largest supplier of both microcomputer software and microcomputer magazines. Microsoft Far East is, according to officials of Microsoft Inc. in Bellevue, WA, a wholly owned ASCII Corp. subsidiary, and Microsoft Inc. owns no equity in it.

One ASCII official estimated last year that ASCII had 30% of the Japanese microcomputer software market, an estimate which if accurate would give ASCII a far more commanding position in Japan than any software company has ever held in the U.S. ASCII certainly dominates the Japanese market for microcomputer languages: All the major Japanese microcomputer manufacturers buy versions of Microsoft BASIC from it. And in fact ASCII seems to dominate the whole Japanese microcomputer software market in a way that no U.S. software company ever has in the American market. Japanese microcomputer stores frequently display catalogues of ASCII software on their walls where there are no rivals' products in sight. ASCII has consistently adopted a low-price policy on its products. It sold cassette software for Y3,200 ($14) and ROM-cartridge software for Y4,800 ($20) or less long before those prices became common in the U.S.

As we'll discuss in the next chapter, Nishi created the MSX group and the project has always been based in Tokyo rather than in Bellevue, WA. Until mid-1984 the "standard" got limited support from Bellevue, but ASCII Corp.'s place in the world's second largest -- and fastest growing -- computer industry assured it of worldwide importance even if support from Bellevue had remained lukewarm. Starting with the June 1984 Consumer Electronics Show, however, Microsoft in Bellevue has been more aggressive in promoting MSX.

## 2.2 A Unique Approach to Standards Development

Americans often criticize Japan's business society as less creative than America's. Occasionally they dismiss the whole Japanese economy as one big cartel. But one strength of the Japanese is that they are a bit more willing than Americans to conform to an emerging standard and even help one to emerge. And large Japanese companies, unlike many large American companies, are not so bureaucratic that they cannot innovate.

In home computers most of the major electronics vendors each company that leads the world in a particular technology developed an interface that would tie MSX home computers to its particular product. That interface would function as a sort of prototype for MSX group standards on the handling of that product.

The specialties have included:

- computers from Yamaha Corp. that can run the software of the others but can also either function as an electronic organ themselves or work with Yamaha keyboards to produce music with as many as 32 voices;

- computers from JVC which work with and help control video tape recorders;

- computers from Pioneer that control a laser disk player.

- computers from Mitsubishi that control home audio systems;

- computers from Nippon General Corp. that are built into a television set (it's reported that larger companies -- Matsushita and Sharp -- are also playing a role in the development of the computer-built-into-the-TV);

- computers from Sanyo with a light pen built them.

## 2.3 Bringing MSX to the World

Sony and probably Matsushita (the largest consumer electronics producer in the world and the maker of Panasonic and Quasar brand products) are expected to lead the charge of MSX suppliers into the U.S. market. Probably three or four other Japanese manufacturers will also enter the fray at the same time: late summer or early autumn of 1985. Yamaha introduced the first MSX computer in the U.S. market in January 1985, a specialty music computer sold only through music stores. Hitachi, JVC, Pioneer, Sanyo, Sharp, Casio, and Toshiba are also leading candidates to introduce MSX computers in the U.S.

Masayori Sei, senior vice president for Sony USA, says Sony is now working to design an MSX configuration which will offer clearly superior performance compared with current U.S. configurations. Sony has taken an early lead in MSX sales in Japan, where Sony usually trails Matsushita by a wide margin. Sony's trendy marketing skills have proven effective in selling MSX computers, perhaps because the machines until recently had to be sold without disc drives and were thus primarily good for playing games. Masao Morita, son of Sony chairman Akio Morita,

is the champion of the MSX project at Sony. He spent most of the 1985 U.S. Winter Consumer Electronics Show posted by the Sony computer at the MSX booth, and promised inquirers that Sony would sell "a lot" of MSX computers in the U.S. by the end of the year.

Matsushita is keeping quiet about plans in the U.S. market. Its MSX promotions in Japan have so far featured a provocative picture of a gorilla but have given the user no good reason to actually go out and buy the machine. Spokesman Ken Shimba insists that no decision has been made on selling MSX computers in the U.S. However, other sources in Matsushita say this is simply public relations comparable to the denials issued by IBM before a new product announcement. Other Japanese electronics industry sources are counting on Matsushita to provide leadership for the MSX group. Matsushita not only participated actively in the MSX booth at Winter CES, but also showed in its own booth an impressive computer-based home-of-the-future.

Sony, Toshiba, Canon, Sanyo, and Philipps introduced MSX machines in Europe with considerable fanfare in September 1984. Sales were reported brisk in Italy, limited only by the inability of the makers to meet demand. Sales were somewhat slower in northern Europe.

The Yamaha music interface and the Pioneer laser disk interface give those two companies clear, if small, niches in the U.S. market, and a Pioneer product is almost certain to join the Yamaha music computer as an early entry in from the MSX Group.

One significant question remains: what RCA, Zenith, and other large U.S. companies that haven't enterred the home computer market will do in the home computer business. RCA and Zenith still have some 40% of the U.S. market for televisions between them, and have played a key role in the expansion of Japanese-developed VCR technology.

RCA chairman Thornton Bradshaw said at a securities analysts meeting earlier this year that "home computers" was one sector RCA expected to use for future growth. RCA spokesmen refuse to elaborate, but RCA is known to have been considering using the MSX standard in some future products. RCA's most recent consumer electronics experiences -- introducing RCA's own videodisk system and introducing videorecorders manufactured largely by the Japanese -- will certainly dispose the company to consider any Japanese standard very closely. RCA has made large profits handling Japanese-made videorecorders while piling up hundreds of millions of dollars in losses on its own videodisk system, which it recently abandoned.

Zenith's interest in MSX is even more clear. Zenith executives were prominent at a party given by Microsoft at the June 1984 Consumer Electronics Show and at a Computers and Games Conference the next day Arthur Lambert of Zenith, serving as a panelist, spoke positively about MSX. When the standard was criticized, he rejoined that he thought "MSX would be successful here. The Japanese have been late on other products before and that hasn't kept them from being successful."

General Electric showed home controllers at the Winter Consumer Electronics Show based on proprietary operating systems. GE's current management is committed to avoiding businesses where it cannot be a leader. For a year or two, at least, General Electric seems unlikely to support the MSX standard.

Korean companies -- perhaps the most competitive MSX manufacturers -- have been looking for distribution in the U.S. since the January 1984 Consumer Electronics Show. They would like to produce private label computers, but their machines are unlikely to arrive in the U.S. before the Japanese legitimize the standard. The Koreans produce computers and can include the computers in a wide variety of other electronics products, but until recently they have said they would have to purchase their disk drives from the Japanese. Today the Koreans may be able to produce 5 1/4 inch disk drives extremely competitively, and they may soon be able to produce 3 1/2 inch disk drives as well.

# Chapter 3

## THE HISTORY OF MSX

The history of MSX is in one sense a story of two small-time New York watch importers and of how and they and their friends among the hard-working wheeler-dealers of Hong Kong tried to give Americans the first true home computer -- a machine with far more power and features than Commodore's 64 or Atari's 800XL. But before the story even gets going it becomes the story of Kazuhiko "Kaye" Nishi, the Japanese entrepreneur who convinced the entire extended family of the Japanese electronics industry to adopt an expanded version of the watch importers' vision.

It's about 20 months since Microsoft Corp., which Nishi serves as vice president, planning, formally announced the MSX standard, which is based on the watch importers' computer, the Spectravideo SV-328. Microsoft said at the announcement that it would take two years for MSX computers to equal or surpass computers from established brands. The Spectravideo SV-328 arrived on the U.S. scene at about the same time as the Microsoft announcement, but it was considerably less revolutionary than its designers had hoped because the Commodore-Texas Instruments price war had by mid-1983 brought the Commodore machine and some other 64K products below the price where the Spectravideo group had planned to sell the Spectravideo. Spectravideo made little impact on the market because the company totally lacked the capital to compete against such big-league rivals. For much of 1983 Spectravideo couldn't even deliver computers to its dealers, much less provide adequate software and support.

That was too bad. Spectravideo's Harry Fox and Alex Weiss, and their Hong Kong partner Peter Law had a computer with important, though subtle, strengths. Many of them came from Nishi, an inter-cultural wheeler-dealer whom Fox, Weiss, and Law met only a few hours before he began redesigning their machine.

The development of the MSX is thus one of the most colorful stories in the colorful microcomputer business.

## 3.1 The Opportunity

In early 1982, when Fox and Weiss set out to build a "true" home computer, the term "home computer" usually applied to machines like the Sinclair ZX-80 which cost about $100 but could do almost nothing useful. "We were in the watch business in New York, and we could see that the way the technology was going, the product we were importing was going to cost about six cents, and there would be no way you could continue making money on it," Fox recalled during a joint interview with Weiss and Kaye Nishi at the January 1984 Consumer Electronics Show. On the other hand, Fox and partner Weiss noted that the same technological changes that meant watches would be worth only a few pennies at wholesale also meant truly useful home computers could be produced for only a few dollars more than the Sinclair ZX-80.

They said they had calculated that in Hong Kong they could arrange production of a computer based on the Z-80 microprocessor, with outstanding graphics and sound and a full keyboard, for about $30. Thus, even taking account of the substantial margins required to support a computer in the marketplace, they could sell the machine for a bit over $100. Fox and Weiss talked with Law, whose Bondwell Holdings had produced watches for them and also for Timex, and chose the name Spectravideo.

Fox set out to hire Microsoft Corp., which had produced operating systems and other basic software for IBM, Apple, Radio Shack, and a host of other manufacturers, to write the system software for the Spectravideo.

He launched a campaign to capture Microsoft's interest. It consisted largely of long-distance phone calls from Hong Kong. "It took about two months to get them to take us seriously," he recalled. "Then finally I got through to Kaye Nishi and he asked me to send him our specs. He got them and he was all excited. Within about ten hours he was on the plane to Hong Kong."

Nishi's excitement indicated more than an appreciation of Fox' idea. Computers are one of the few manufacturing businesses in the world where the U.S. and Japanese markets have remained largely separate until recently, with completely different brands dominating in the two countries. In 1982 the separation was almost complete (and a machine Nishi designed -- the "lap" computer produced by the Japanese manufacturer Kyocera and sold

in the U.S. as the Radio Shack Model 100 -- is probably the most successful Japanese computer in the U.S. market to date).

Nishi and many others in the Japanese electronics industry had, like Fox, noted that technology was making true home computers possible. But the Japanese home computer market made the U.S. market look simple by comparison. Home computer software in the U.S. could be written in only a few formats: Apple, IBM, Sinclair, Atari, Commodore, and Texas Instruments. In Japan it seemed every electronics company was introducing its own "home computer" totally incompatible with everyone else's. By mid-1983 a foreigner was able to find a video game in 14 different formats in one Ginza store. Everyone except perhaps some salarymen at Nippon Electric Co. (NEC), which had the largest market share in Japan, agreed that some kind of standardization was needed.

Nishi, co-founder of ASCII Corp. in Japan and vice president of Microsoft in the U.S., is the most important bridge between the Japanese and U.S. computer markets.

By early 1982 Japanese electronics leaders were already calling ASCII-Microsoft Corp., the ASCII Corp. subsidiary which handled licensing of Microsoft products and sold other basic software products, for the same type of help Spectravideo sought. (Today the same subsidiary goes by the name "Microsoft Far East.) Some -- notably Kazuyasu Maeda and Dai Akutani of Matsushita Electric Corp. -- were already calling for new standards in the industry.

Nishi is an idea-man in a country where possessing original ideas is considered a bit impolite, especially for people under the age of 65. Moreover, in seeking industry agreement on a standard, Nishi faced a problem common to standard-setters everywhere. If he proposed accepting as standard something that was already on the market, producers whose product was not accepted as standard would feel they were losing competitive position. If he proposed a totally new product as standard, he would have to justify his own original idea to the entire industry -- and it's tough to justify your own original idea in Japan without sounding rude.

## 3.2 Designing for Spectravideo

Thus Nishi found the Spectravideo proposal was extraordinarily significant. Nishi knew that the configuration that Fox proposed could create an unusually capable, flexible home computer. He knew that a computer based on the technology Spectravideo expected to use could rival expensive office machines in processing capability, produce superior graphics and sound, yet cost perhaps half as much to produce as a computer based on Intel 8080 series chips, which power the IBM Personal Computer.

Nishi arrived in Hong Kong within 48 hours of his conversation with Fox and rode directly to Bondwell Holdings' offices, where a Spectravideo headquarters had been established. "He looked at our plans and he began saying immediately, `Change this here, change the pin-outs over here, make this bigger,'" recalled Weiss. In two days in Hong Kong Nishi:

- reorganized the computer's layout to make it more easily expandable;
- expanded the computer's read-only memory (ROM) several-fold to 32K;
- made the computer's random-access memory expandable to as much as 256,000 bytes of RAM;
- promised that Microsoft would develop a BASIC for the computer even more powerful than the BASIC in the IBM PC;
- made it easy for the computer to support such add-ons as an 80-column card and to access a disk drive in the same way that professional computers do;
- set up an easily programable interrupt system so the computer can, for instance, continue monitoring a home security system at the same time the kids are using it to do their homework;
- reworked the computer's keyboard to include such word-processing innovations as select, insert, and delete keys, which Nishi would make a widely accepted micro-computer word-processing tool with its inclusion in

the Radio Shack Model 100 and related computers such as the NEC PC8201.

When he was through, Nishi had produced a machine that would cost significantly more to manufacture than Spectravideo had originally intended. But it was also a machine that -- unlike any other computer less expensive than the Apple II series -- could do virtually everything a business computer could do and yet also had the graphics, sound capability, and ROM cartridge slot needed for a great entertainment machine. And Nishi pointed out that the price would fall further as technology improved. "He said to us, `Don't worry, you can sell this same machine for five years,'" recalls Fox.

## 3.3 The Japanese License the Spectravideo Design

If Fox and Weiss felt a bit overwhelmed watching Nishi leave, they were even more overwhelmed when they got another call from Nishi eight months later in April 1983. "The entire Japanese electronics industry wanted to license our design. And they weren't going to pay us more than a few cents a machine," says Fox.

Nishi had gone visiting the leading Japanese electronics companies. He had carried with him a mock-up of the Spectravideo SV-328, and showed off its diverse features. The reaction had been, "That's very good. Make us something like that." The Matsushita leaders had been especially impressed, and had seen the Spectravideo as an ideal basis for their dream of a home computer standard that could be accepted by the entire Japanese electronics industry.

Fox was accustomed to negotiating watch import deals, but never before had he negotiated with a united front of the electronics companies from the world's most advanced manufacturing nation. Moreover, he had to admit that much of the design consisted of Nishi's ideas, and he hardly felt he could hold out for a high price when selling Nishi back his own ideas. He essentially gave the design away. "At first they talked about a license for Japan only. But then they said they wanted to be able to sell it all over the world," Fox recalls. He wanted exclusivity on the Spectravideo SV-328 design. He suggested that

Nishi prepare a new design, "enough different so that you don't have to license it from us, but close enough so that you can make our machine compatible with an adapter."

The MSX project was born.

## 3.4 Becoming a Standard -- Slowly

Most of the employees at Microsoft's Bellevue, WA, headquarters were as surprised as anyone in the U.S. computer industry to learn in July 1983 that Microsoft was teaming up with the Japanese electronic industry to produce an 8-bit "standard" computer. "Most of the people there didn't hear about it until about a week before the public announcement," says Steven Ting, a Chinese-American engineer Spectravideo had hired to bring its plans to fruition. The project has always been a project of the Tokyo-based ASCII-Microsoft affiliate rather than a true Microsoft project, and even today specifications of the computers published in English for those seeking to provide software support contain significant amounts of Japanese-style English even though they bear the legend "(c) Microsoft Corp."

In the first half of 1984 ASCII Corp. staff members complained that Gates and other U.S. Microsoft executives did little to promote MSX in the U.S., noting that though the giant European firm Phillips (which markets Magnavox and Philco products in the U.S.) had licensed the right to make MSX machines -- largely at the urging of employees based in Tokyo, not Bellevue, WA -- Microsoft has yet to announce the sale of a single license to an American firm. On the other hand, ASCII Corp. staff acknowledged that ASCII persuaded Gates to accept royalties on the MSX substantially lower than Microsoft gets from sales of Apple, IBM, and Radio Shack systems based on Microsoft software, so the U.S. headquarters of the company has little incentive to help MSX defeat these established rivals.

In Japan's home market the limited communication between ASCII and Microsoft's home office had little effect on product introduction: MSX computers from Sony, Yamaha, Matsushita, Sanyo, and other leading Japanese electronics companies began arriving in Japanese stores only four months after the initial announcement of the standard. And the support of such a wide array of Japanese hardware companies quickly gave the MSX standard an ability that no other computer, even IBM's, can claim

-- an ability to talk through standard interfaces with almost every appliance you may have in your home except possibly your kitchen sink. ASCII-Microsoft had also enhanced the Spectravideo design in a number of other ways. The computer was now, for example, capable of accessing as much as 1,024,000 bytes of RAM.

The 1983-84 MSX computers were still fairly limited machines, however. Though various hardware manufacturers had produced MSX interfaces for a whole array of home electronics, most of the interfaces were only on the market for the MSX computers of the companies that had developed them. There were no disk drives for the computers until July of 1984 and there was no disk operating system until early 1985. (People who used disks were supposed to use them only store data using "disk BASIC.")

From the beginning, Nishi and Microsoft programmers had high hopes for MSX-DOS, the disk operating system that would work with MSX computers. Because MSX machines had a Z-80 chip inside, the programmers wanted to enable MSX computers to run the vast library of CP/M-80 programs written for the Z-80 chip without modification. But they also wanted MSX computers to be able to read data created on an IBM PC and work-alikes. And of course MSX-DOS also had to be able to use the whole array of sophisticated graphics and sound features built into the MSX.

Disk-based software for the MSX is only now coming to market, so older computer formats could until recently do many jobs -- creating some types of graphics, for instance -- better than MSX. Moreover, most CP/M software assumes a large, business-sized monitor and sells for high business-user prices. There is still only a modest amount of home-user software available in the 40-character-per-line format which MSX computers normally run on a home television. (Forty characters per line is the most that can easily be displayed on a conventional home television screen, anyway, and will be all MSX can display until an upgrade expected in May of 1985.)

The participants in the MSX group sought only slow growth for the first two years of MSX -- the period through the third quarter of 1985. A prospectus prepared in Japanese (translated in Appendix I) and distributed on April 25, 1984 projected sales of only 500,000 units through 1984 in Japan, even though some two dozen different models were available from a dozen different manufacturers. The Japanese were clearly handling MSX as an experimental product.

In Europe where introduction was scheduled and carried out in September 1984, the prospectus projected European sales of only 100,000 units through April 1985 -- a forecast which proved close to the mark. Sales were limited everywhere by shortage of

product. They were extremely strong in Italy, where Philips led the introductions, up to expections in northern continental Europe, but limited in Britain by the perception that the product, at $300 for an entry-level system, was overpriced.

The European introduction suggests that introduction in the U.S. could be carried out cautiously as well: there will be voices in the Japanese computer industry seeking to move cautiously in the competition with Commodore, Apple, and IBM, at least at first.

But at the same time the Japanese were demonstrating their long-term commitment to MSX and to upgraded versions of MSX. In September 1984 a high-ranking executive of a major American software firm that competes with Microsoft -- a firm that had previously been extremely skeptical about the MSX' success -- reported that he had been asked by leading Japanese electronics companies to propose a long-term planning process for the expansion of MSX-compatible computers in the home market for the next three to five years and beyond. The Japanese government's information network system (INS), to be based on experiments currently underway in Mitaka City (see Chapters 4 and 7) deeply involves the Nippon Telephone and Telegraph Corp. and the major electronics manufacturers, and provides a perfect framework for MSX development.

Major Japanese manufacturers showed MSX computers with little fanfare and even little supporting explanation at the Winter Consumer Electronics Show in Las Vegas, NV, in January 1985. U.S. pundits were unimpressed, because the applications shown -- other than a Pioneer laser disk game which sat inoperative for most of the show because Pioneer had not sent a supporting person to work it -- added little to the applications that could already be done with other computers. But Matsushita/Panasonic, which had until that time stoutly denied any plans to ship MSX computers to the U.S., offered a large display at the MSX booth and also showed a computerized "home of the future at its own booth." Masao Morita, son of Sony chairman Akio Morita, spent most of the show standing next to Sony's MSX computer. He continually repeated that it would take a couple of years before the Japanese vision of the computer that aids daily life can be fully realized. But he promised to sell "a lot" of MSX computers in the U.S. before the end of this year. Distributors showed considerable interest in these brand-name computers, but software developers showed no understanding of the group's purpose or potential impact.

Also in January, Yamaha introduced the first MSX computer in the U.S., a specialty music computer with its digital synthesizer built in. Neither Yamaha nor JVC participated in the Consumer Electronics Show, however, so the computer world did not see its

machine or hear its incredible capabilities. Yamaha confined distribution to music stores. The MSX group decided to delay entry into the U.S. market until upgrades due in late spring could be completed. Formal product announcements were expected at the June Consumer Electronics Show, with shipments expected late in the third quarter.

# Chapter 4

## THE CAPABILITIES AND POSITIONING OF MSX COMPUTERS

The MSX is best described as an architecture whose capabilities closely resemble to those of the IBM PC or PC Jr., but which has been designed for much cheaper manufacture. It is positioned to do for the home market what IBM products did for the office.

It is important to distinguish among:

- the capabilities of a basic, introductory level MSX machine like those that were introduced into the Japanese market in 1983.
- the capabilities of the generation of MSX machines introduced in the Japanese and European markets for the end-of-1984 buying season.
- the capabilities of the new generation of MSX machines likely to be shipped in the third quarter of 1985.
- the capabilities of the approach to home computing of which MSX is only the initial indicator.

The best way to understand the capabilities of the MSX architecture and likely improvements is to think of the MSX group as bringing to the home market roughly what IBM brings to the office market, but doing it about three years after IBM does it, and at much lower cost.

## 4.1 The Limitations of the Initially Introduced MSX machines

There's little in the experience of the U.S. or European electronics industry that's comparable to the joint introduction in Japan in 1983 of MSX computers with extremely limited capability from a dozen different manufacturers. The closest analogy might be the introduction of various videotext terminals from such manufacturers as RCA and AT&T in the U.S. market at about the same time: the products were frankly of modest usefulness, but represented experiments with new technology and new standards.

The majority of MSX machines shipped in Japan through the beginning of October 1984 had only 16K of memory. Virtually all came with no disk drive. They were useful mainly to parents of junior high school students who wanted to buy something that would not quickly become obsolete.

Most of the machines introduced by a dozen different manufacturers were nearly identical, containing similar components from similar suppliers with one or two special features added not so much for immediate appeal to the consumer as because the manufacturer wanted to experiment with a particular technology. MSX pricing -- generally a bit higher than Commodore/Atari/Coleco prices in the U.S. at the same time -- indicated both the machines' experimental status and the fact that as a new architecture MSX did not yet benefit from the manufacturing economies of more mature architectures.

## 4.2 The Current Capabilities and Positioning of MSX

The 1984 generation of MSX computers was analogous to the IBM PC at the time of its introduction in 1981. It's difficult to remember now, but in early 1981 it was common for Americans to complain that IBM really had no interest in microcomputers, was ignoring the field, and really had continued ignoring it for so long that it was probably too late for an intelligent entry anyway.

Interestingly, the computer that was No. 1 in all U.S. markets in 1981 -- the Apple II -- is almost exactly the same computer which today is the most respected product in the home market. Computer technology has not so much changed rapidly over the past five years as it has matured: manufacturing methods have improved, prices have declined, companies have figured out better ways to use the technologies, and more and more people have learned how to put the new technology to work. The declining prices, maturing software base, and spreading knowledge have brought the computer into a larger and larger array of applications.

Before 1981 the truly productive applications of the microcomputer were largely confined to people whose jobs required them to be technically literate. In the first half of the 1980s the computer became genuinely useful to businesses, and also became a household toy. It's still not genuinely useful in homes today except perhaps for teaching about computers and for word-processing high school students' school reports. A computer with a disk drive, a printer, and a 1200-baud modem still costs $1,500 or so -- an exhorbitant price for such limited functionality. Interfaces with other household devices are prohibitively expensive and -- if the home computer is an Apple or Commodore product -- they cannot operate the home devices while the computer efficiently performs other tasks.

The current generation of MSX machines in Japan and Europe exceed the capabilities of the Apple II series by roughly the margin that the initial version of the IBM PC exceeded the capabilities of the Apple II series. But it's important to remember that the IBM machines sold in the 1981 and 1982 exceeded the capabilities of the Apple II by a much more modest margin than we might think looking at the IBM PC's functionality today. Though the IBM machine of 1981 could support vastly more memory than the Apple II, it was generally sold with 64K or 128K. Its disk drives were single sided. IBM sold no high-capacity hard disk.

The initial advantages of the IBM personal computer were:

- greater speed which was achieved not by true 16-bit technology but by use of a chip which was 8-bit internally but worked much faster than the chips in the most popular computers of the time;
- larger memory capacity if you wanted it;
- a much more solid feel to the whole machine;

- expandability which obviously exceeded that of competing products, and

- the support of a company which genuinely knew how to serve the users the product was designed for.

IBM's takeover of the office market was gradual, but within two years of the product's introduction it was an accomplished fact.

The 1984 generation of MSX products offered exactly the same advantages over existing home computers that the initial IBM PCs possessed over the business computers of the time, but it also possessed similar limitations.

In speed, the MSX configuration is best described -- both in its 1984 incarnation and in expected 1985 versions -- as much faster than the Apple II series and the Commodore 64; generally a bit slower than the IBM PC. Taking clock speed of the microprocessor as a rough indicator, the relative speeds are:

6502 processor - 1.0 megahertz
MSX Z80 - 3.5 megahertz
IBM PC - 4.77 megahertz

In memory capacity, MSX's 16 slots can support 64K of random access memory each for a theoretical total of up to 1,028K. However, these are the same slots through which peripherals are addressed, and a slot which is occupied by a peripheral cannot be used for additional memory. Thus it is unlikely that programmers will ever use more than approximately 14 slots of memory or 896K. But that's still 40% more than the IBM PC. The most powerful MSX computers manufactured as of the first quarter of 1984 had 64K of built-in memory, which may have been all they could reasonably have used without a disk operating system. However, 64K expansion cartridges have been shipped in Japan and executives of Japanese companies say they are considering products with more memory for the U.S. market.

The current generation of MSX machines also faces a software shortage, though not a shortage nearly as large as for the Apple Macintosh and the Atari SE series. Much of the available CP/M software is not suitable for home use, and many of the MSX games produced in the Japanese market to date have been low in quality, seemingly oriented toward using no more than the 16K of memory available in the majority of available MSX computers in Japan. Thus there will probably be a shortage of high-quality software through 1985.

In sum, the initial positioning of MSX is as a standard, but still limited, home computer. MSX seeks to be to computers what Chevrolet and Ford once were to cars: perhaps a bit more expensive than a Nash Rambler (a Commodore 64), but much cheaper than a Cadillac or Buick (an IBM or Apple computer). And known for reliability and functionality.

## 4.3 Immediate Improvements in MSX

If the current shipments of MSX computers provide a small but significant increment in performance and reduction in price compared with competitive computers, additional dramatic improvements in functionality will occur during 1985 and again 1986 and 1987. This period will correspond to the period in 1982 and 1983 when IBM gradually asserted dominance over the office microcomputer industry.

MSX memory will become readily expandable to an amount which will exceed the IBM PC's (though at the same time IBM will be introducing additional computers which support more memory too). The MSX group will either begin supporting a hard disk or introduce methods of writing on 3 1/2-inch floppies which permit storage of the amount of data which now goes on a hard disk -- 10 megabytes.

Graphics capability will be upgraded and 80-column support will be added. ASCII Corp., Microsoft, and Yamaha have designed a next-generation graphics chip which offers 512 x 212 graphics resolution and up to 256 colors. Its cost is said to be identical to the cost of the Texas Instruments 9918A graphics chip it replaces. It also allows 80 columns of text to be displayed. (Most home televisions today don't have the resolution to display 80 columns of text clearly, but an 80 column display is considered a necessity for high-quality word-processing and analytical work on a computer. Without one the user can only see a small portion of the document being processed or the information being analyzed. Eighty-column display support is standard on the Apple IIc but available only from third-party vendors for the Commodore 64.) In addition to the new graphics chip, the upgraded MSX will contain an increase in video RAM to 64K and additional read-only memory for expanded BASIC functions.

The most obvious difference between MSX and non-MSX home computers such as the Commodore 64/128 series, the Atari XE series, the Apple II series and the IBM PC Jr. is likely to be in disk drive capability. The standard MSX disk drives will be Japanese-made 3 1/2 inch products designed to hold several times more data than Apple and Commodore disks and to load much faster. (The MSX drives will also be better buys than IBM PC Jr. drives which are less convenient and more expensive than the latest Japanese products.) Virtually all new lines of computers introduced recently have used Japanese 3 1/2 inch drives (the Macintosh, the Atari SE series, Hewlett Packard and Data General products). But the older computer lines which offer the toughest competition for the MSX standard because of their larger installed base and larger selection of software face serious difficulties in shifting to the new technology without abandoning those advantages. This is particularly true of Apple and Commodore, whose idiosyncratic disk operating systems would have special difficulty utilizing the strengths of the new technolgy.

Because they will be built by Japan's leading manufacturing firms, it's reasonably certain that the MSX computers which come to the U.S. will have the solid construction those firms' products are known for. Their expandability will obviously exceed that of the Apple IIc and the Commodore 64. Even against the highly expandable Apple IIe, the Z80 microprocessor will give vastly increased ability to handle multiple tasks at the same time and enough power to handle more memory. And they will have the support of the entire network of consumer electronics specialists Japan's leading companies have developed for sale of their televisions, video tape recorders, etc. On the other hand, an improved IBM home computer could still provide virtually all the advantages MSX will offer at this stage and might command a greater premium in the market than products from Sony, Panasonic, et. al.

Despite the great long-term possibilities of interfacing home computers with other Japanese-made appliances, the initial support for such products may be limited. It took IBM several years to deliver products which interfaced its PC to its mainframes. Three products seem ready to go:

- Some Japanese (and possibly Korean) televisions will certainly arrive with computers built in.

- Pioneer's laser-disk/computer interface has been highly popular at trade shows.

- Yamaha's MSX-electronic synthesizer interface is already shipping in small quantities. It will surely be moved to the consumer market, where it could immediately become a

very hot product.

Matsushita has been showing prototype home control systems since 1979 and has delivered a small number in Japan based on an earlier home computer it produced. It's not clear how soon Matsushita or other large Japanese companies will move into multi-purpose home control. It's also not clear how much additional functionality can be provided -- especially at first -- by interfaces with a video tape recorder or a home audio system. Mitsubishi has stopped advertising its audio system interface as a major sales point in Japan.

There are conflicting reports about the pricing policies Japanese firms will adopt. To some extent, the leading Japanese firms have strong incentive to maintain a premium image for their computers. They may have difficulty over the long-term meeting the prices that Korean firms will be able to offer. But second-tier Japanese firms have intense incentive to move quickly and price aggressively. Kevin Elias, a JVC distribution executive, predicted last year that MSX computers would be priced extremely competitively against Commodore's offerings. Perhaps the most likely event is that the basic MSX computers will be priced somewhat under $200, which will place them a bit above Commodore but far below Apple and IBM offerings at the time. It was said at the January Consumer Electronics Show in Las Vegas that a 64K Spectravideo unit that contains a built-in disk drive is designed to retail for $299 this year.

The Japanese' greatest manufacturing strength is in disk drives, and Japanese sources say the MSX disk drives are likely to be priced below the computers and that their prices will soon go under $200.

Meanwhile, prices will drop rapidly, especially as private label MSX computers produced in Korea and Hong Kong are introduced. An MSX prospectus produced by Microsoft Far East in April of 1984, which is translated in Appendix B, listed the following as typical configurations and prices that would apply during this period:

- a basic machine, capable of playing games but without a keyboard, would cost Y20,000 ($87).
- home computers with a keyboard and 16K of RAM (expandable to 1,000K) would cost Y30,000 ($130).
- complete home personal computer systems with one floppy disk and 64K of random-access memory (RAM) would cost Y50,000

($220).

- More advanced personal computer systems with 2 floppy disks and additional features would cost Y100,000 ($435).

- Business computers with a disk capable of storing millions of bytes of data would cost Y200,000 ($870 - perhaps one-third of the cost of similar systems in the U.S. today.)

During this period, third-parties will begin to use MSX computers extensively for home control because of their obvious advantagees over rivals: low-price and an excellent interrupt system. Home telephones will appear with MSX computers built into them. But if the advance of the IBM PC into the office has demonstrated anything, it is that networking is one of the most complex issues in microcomputing. IBM is only now introducing its first local area network, and it is a limited system. It's unlikely that the MSX group will introduce a standard for networking appliances in the home until 1987 at the earliest. But when it comes it will be an important product indeed.

Based on past sales of home computers and other electronics products, it is possible to project the installed base of MSX machines as:

Perhaps 350,000 in the U.S., 1.2 million worldwide by the end of 1985.

end of 1986 - 1-2 million in the U.S., 3-5 million worldwide by the end of 1986.

end of 1987 - 3-5 million in the U.S., 7-10 million worldwide.

It's a safe bet that by 1987 more software will be written for MSX (or whatever MSX has become by that time) than for any other format including IBM's.

## 4.4 MSX and Its Successors

The MSX Group is now discussing how to upgrade the MSX microprocessor to a true 16-bit chip. Some parts of the group hope to offer a co-processor, either an Intel 8086-series chip or a Motorola 68000, very soon -- probably during 1986. But the

mainstream of the group seems committed to upgrading the microprocessor to a custom, Japanese-designed microprocessor which would be capable of emulating the Z80.

Some time in the later half of the 1980s the MSX program will come together with several other programs now under development to create truly revolutionary developments. These programs include:

- the development of an information network system (INS) by the Japanese Ministry of Posts and Telecommunications, Nippon Telephone and Telegraph Corp., and the Japanese electronics industry.

- the conduct of a wide array of experiments in Japan on how advanced technology can be used in the home of the future,

- the development of an upgraded product which will bear a relationship to the MSX analogous to the relationship that the IBM PC AT bears to the IBM PC,

- the development of standards for transmission of high density digital home television pictures on fiber optic cable.

A Japanese-language article in the September 1984 issue of ASCII magazine, published by ASCII Corp., suggested that an upgraded version of the MSX would be the main computer used with the INS network standard. It predicted that along with the INS standard the electronics industry would develop a "home bus" standard which would carry electric power, local area computer networking, and two-way digital audio and video throughout the homes of the future, replacing the electric and telephone outlets in today's homes.[1] At least one other U.S. computer software firm besides the Microsoft/ASCII Corp. alliance has been asked by the Japanese electronics industry to suggest how such advanced computer networking in the homes of the future should work.

In the short run, there's very little in the home that cannot be done by MSX' Z80 microprocessor. But the ambitious (but realistic) hopes of some Japanese for home computing will

---

1. The English-language rights to this article are owned by MSX World, published by Qest Publishing, 39 W. 32nd St., New York, NY, 10001.

undoubtably make more sohisticated hardware highly useful.

To make all this work, the Japanese must either set or adopt from elsewhere standards covering a great array of aspects of computing and communicating. To date, the Japanese haven't particularly aspired to be standard-setters, and to a large extent that probably won't change. As long as standards are available elsewhere that the Japanese can adopt, they're likely to adopt them. The Japanese will follow IBM's lead wherever they can do it without pricing themselves out of the market. But in computing, especially home computing, that hasn't proved practical. U.S. hardware companies don't want to set universally accepted standards in the hardware business -- largely because they would immediately face tough competition from superior manufacturing abilities in the Orient.

While IBM did not fear to set a standard when it introduced an office computer, its home computer is based on a proprietary graphics chip. And the high price charged by Intel (now 20% owned by IBM) for its 8088 chip has made it difficult for IBM-standard computers to be made as cheaply as other computers with the same functionality.

Thus it's likely that the MSX group will set the world standards for many computer activities in the home -- and that the results will be at least as exciting as the introduction of the automobile or television into ordinary people's lives.

# MSX AND THE COMING REVOLUTION IN CONSUMER ELECTRONICS

CHAPTER 4

# Chapter 5

# MSX AND THE COMPETITION IN HOME COMPUTERS

The MSX standard is likely to dominate home computing, but its triumph may not be quick or easy. Companies can be hurt by jumping on the MSX bandwagon too forcefully too soon. And MSX may not be as triumphant in the educational market -- currently dominated by Apple -- as in homes.

## 5.1 MSX vs. Apple and Commodore in the Home Market

Two similar products, the Apple II series and the Commodore 64, dominated home computing in the U.S until early 1985. Both machines are built around the 6502 microprocessor, a chip which is widely considered less sophisticated than the Z80 which powers MSX or the 8088 which powers the IBM PC. In the short run, the large software base of Commodore and Apple computers could give MSX difficult competition in the home market. But in the long run it is hard to imagine how Apple and Commodore could defeat the entire Japanese electronics industry.

Commodore and Apple's installed base haven't made the two companies impregable powerhouses in the U.S. microcomputer market. Nearly 5 million Commodore 64 and Apple II-series computers have been sold, but they are present in much less than 10% of American homes. Many Commodore computers, especially, have been sold without disk drives or without printers. They are not configured to do anything useful. After fairly unsuccessful attempts to manufacture their own peripherals, Apple and Commodore now import disk drives and printers from Japan. Since the cost of the printer and the disk drive can amount to up to 75% of the cost of a useful home computer system, it's at least arguable that useful Apple II and Commodore 64 systems are already more Japanese than American.

In short, Apple and Commodore are far less dominant in homes today than Apple, Radio Shack, and CP/M systems were in businesses in 1981 when the IBM PC was introduced. Most homes either haven't yet bought a microcomputer or have only experimented with a Timex-Sinclair or Texas Instruments toy. Even many Commodore 64 owners who don't yet own a printer or a disk drive will be able to upgrade to an MSX computer for only slightly more money than adding Commodore peripherals.

The idea that Commodore 64 had become a standard in American homes has recently been destroyed by two factors:

- the slow sales of Commodore 64 in the home market at Christmas of 1984, and
- the introduction of the Commodore 128, a higher-priced machine which, though it can emulate the Commodore 64, also acknowledges the 64's unsuitability as a standard. The 128 has additional memory and greater speed than the 64, but when it is in a mode that takes advantage of those features it cannot use Commodore 64 software. Moreover, the 128 also includes a Z80 chip like that used in MSX computers in order to access the Z80's business software base and more sophisticated capabilities. At the 128's introduction Commodore featured the Perfect Software series, a Z80-based program which will run easily on MSX.

MSX computers and MSX manufacturers have these selling points over Apple II and Commodore 64 computers:

- vastly greater storage on disk drives
- a greater reputation for reliability
- more rapid program loading and disk access than Commodore
- much greater upgradability, especially compared to Commodore
- lower prices than Apple
- much greater compatibility with computers used in the offices where consumers work
- much greater internal speed, which causes increased performance in a great variety of applications

- the ability to efficiently handle interrupt-driven processing, which makes it possible for the computer to do more than one task at a time -- a virtual necessity if the consumer hopes to integrate the computer with other devices in his home.

During 1985, when the software base of MSX suitable for U.S. home use will be significantly weaker than Apple and Commodore's and many of the devices that will eventually support MSX will not be available, Commodore and Apple may outsell MSX machines, perhaps by a wide margin. This is especially true if the MSX computer suppliers do not initially price their product aggressively.

Commodore's upgrade to the 128 has blunted the company's claim that its computer is the home standard, however. Eventually, Apple must upgrade the II series as well. The Apple IIe and IIc do not suffer the obvious performance problems of the Commodore 64 (which can only display 40 characters per line) or a comparable difficulty in creating a fully compatible upgrade. The Apple II series' design has been better documented and -- especially in the IIe -- designed for greater expandability than the Commodore 64. But it still can't handle more than one task at a time, can't handle large amounts of memory, and uses old-fashioned disk drive technology.

Such computers won't be easy to sell much beyond 1985. Thus it's not clear how much the large installed base of Commodore and Apple machines will help these two companies in contention against the MSX group. In the home market, at least, Commodore and Apple's days of leadership seem numbered.

## 5.2 MSX vs. Apple in the School Market

In the school market the competition between MSX and Apple may be tougher. Apple is coming to dominate schools almost as IBM dominates offices.

Moreover, while producing computers for the home market is largely a manufacturing-driven business -- the home consumer has shown that he will buy computers from the supplier who offers him functionality at the right price, regardless of who that may be -- producing for schools is much more marketing-driven. Apple has enormous experience in holding the hands of educators.

And while access to CP/M, Colecovision, and Japanese MSX software bases mean that an excellent home software base for MSX can be built quickly, there will be no comparable school software base for MSX computers in the short run.

Continued Apple success in schools won't necessarily sell Apple computers into homes, however, unless the consumer sees very little price-performance difference between Apple and competing computers. There's very little reason for parents to want to run exactly the same programs at home as are run in school. Parents will want some data compatibility of their computers with their schools' computers -- a kid's report word-processed at home should be editable in school. But since Apple will almost certainly have to upgrade the Apple II-series disk drives with a made-in-Japan product, it shouldn't be impossible for the Japanese to assure that files created on school Apples can somehow be read on home Sonys.

## 5.3 MSX vs. IBM and the "IBM Standard" in the Home

IBM's aggressive marketing and pricing seem to have rescued the PC Jr. from the failure it suffered in early 1984. The PC Jr. has almost all the capabilities that the MSX machines of 1985-86 will have: high-capacity disk drives, a relatively fast microprocessor, a sophisticated interrupt system, and compatibility with a great deal of software, including software used in the offices where many consumers work.

But even with IBM's current aggressive prices and the arrival of even lower-priced PC clones from Asia, it's unlikely that IBM standard computers will be price competitive with MSX products. With an 8088 chip and a larger power supply than MSX machines, the PC Jr. inevitably costs more to make. Though IBM knows more about keeping manufacturing costs down than most of its competitors in the U.S. microcomputer world, it hardly has the mass production genius of the Japanese or the ability to keep costs as low as the Koreans. While an MSX prospectus (see Appendix B) indicated that MSX prices would range from an entry-level $83 to $830 for a product with the functionality of a hard disk office computer like the IBM XT, it's unlikely that entry-level IBM-compatible systems can be sold for much less than $350-400, and IBM has no incentive to cut the cost of powerful systems to levels which would make them attractive in the home.

Thus though IBM-compatible systems will remain serious competitors for MSX, and many MSX-supporting manufacturers will also make IBM-compatibles, it seems that MSX machines have a good chance to sell successfully against IBM from the beginning.

In the long run, the building of microcomputers into appliances will be a crucial battle, and one that IBM is likely to lose if it tries to fight. The leading appliance producers are mainly MSX supporters. It's hard to imagine how the appliance networks of the future could wind up dominated by IBM (or by Apple or Commodore) hardware.

IBM computers will undoubtably be an important factor in the home market for the foreseeable future. They will always be bought by consumers who want compatibility with IBM office systems. But IBM computers are unlikely ever to play the crucial role in the home that MSX computers can play.

## 5.4 MSX vs. (or in Partnership with) Atari

Under the leadership of Jack Tramiel, Atari Corp. is structured very differently from other home computer manufacturers. It is essentially an importing company rather than a manufacturer. Because there are many more manufacturers supporting the MSX standard than there are home computer distribution channels, Atari itself is highly likely to become an important distributor of MSX machines. But whether or not that occurs, neither of Atari's two current computer lines seem to hold great potential for deadly comptetion against MSX in U.S. homes.

Atari's first line, the XE series, is a repackaged version of the original Atari 800 series, which was comparable in features, performance, and architecture to the Apple II-series and the Commodore 64. This series is widely considered a superior product to the Commodore 64, but it still suffers from the same slowness, lack of adequate interrupt capabilities, and obsolete disk drive technology that the other two major 6502-microprocessor-based formats face. In addition, its installed base is weaker than either the Commodore 64 or the Apple II-series.

Atari's second line, the SE series, will be analyzed in the

next section.

## 5.5 MSX vs. the Atari SE series, Amiga, Mindset, and Other Hot-Shot Machines

Perhaps nothing indicates the unfocused wheeler-dealer-ism of the U.S. home computer industry better than fascination with machines such as the Atari SE-series and the Amiga, whose primary attractions are:

- First, the ability to display a wider range of color hues and higher resolution than currently popular microcomputers, and
- Second, the existence of "windowing" software environments for some of them.

The first of these graphics machines to come to market -- the Mindset -- already seems to be a failure. While other such machines may find profitable niches, there's no reason to expect them to achieve the massive sales that would make them a threat to the MSX standard.

Good graphics are obviously important in a home computer, since home computers should be used for an array of entertaining and educational activities that are more fun if they are beautiful. The graphics of the Commodore 64-generation of home computers clearly helped bring them into homes and caused them to displace such products as the Timex-Sinclair 1000.

But there's little other than Silicon Valley fantasy to lead manufacturers to expect enormous numbers of consumers will buy the next -- expensive and software-incompatible -- computer upgrade merely for its excellent graphics. The ability of these machines to run "windowing environments" is not particularly significant: The windowing of Apple's expensive Macintosh may really use the powerful 68000 microprocessor in ways Z80-based computers and others with less powerful processors may be unable to match. But the Digital Research GEM environment which has so impressed viewers of the Atari SE series was originally developed to run on an IBM PC, whose chip is no more powerful than the Z80 in MSX machines. It is too early to judge whether GEM and other

environments that function with standard microprocessors like the 8088 and the Z80 have in fact equalled the Macintosh in functionality, but if they have it will be possible to run such environments perfectly adequately on 1985-generation MSX machines. Several possible approaches to integrated "environments" for MSX computers are currently under consideration, including some proposed by Digital Research. The Macintosh is not priced to compete with MSX and its software is the product of much more fine-tuning than software that will run on lower-priced machines such as the Amiga and the SE-series.

Meanwhile in reality consumers are resisting paying $30 for the latest high-resolution graphics software for Commodore 64 and Atari 800-series machines. They're not anxious to run out and spend $1,000 or so for machines that will display 512 colors rather than the 256 the new generation of MSX computers can handle. And even the Atari SE series demands a nearly $1,000 investment because most consumers will have to buy a disk drive and a new color monitor to benefit from it.

The proper approach to improved graphics is to find ways of upgrading already existing architectures to accomodate them. Any architecture designed to last should have been built with the need to do this in mind. (MSX was.) As discussed in previous chapters, the MSX group has created a new video display processor that will nearly match graphics capabilities of the SE series and the Amiga without obsoleting any existing MSX software. Though MSX still won't have the speed of the latest machines until the MSX group upgrades its microprocessor, MSX computers are capable of imitating the Macintosh roughly as well as the SE series if Japanese manufacturers want to do it.

Home computers with the graphics capability of the Amiga, the Mindset, and the SE series will eventually reach millions of homes. But when they do they are likely to have three letters on them: MSX. If MSX faces a serious threat from new generation computers with powerful graphics abilities, they are likely to be new generation computers from Apple and IBM rather than from any of the companies that have announced color graphics machines so far.

# MSX AND THE COMING REVOLUTION IN CONSUMER ELECTRONICS

CHAPTER 5

# Chapter 6

## MSX AND THE HOME OF THE FUTURE

The long-term outlook for home computing can best be summarized by saying that the upper-middle-class home of the year 2000 is likely to be quite a bit like it was described in science fiction books -- and most components of the 21st century home are likely to arrive a few years early.

Almost all of those components are likely to trace part of their ancestry to the MSX computers that will be introduced into the U.S. in 1985.

Most experts -- and science fiction writers -- have always agreed that the appliances of the future would talk to each other. But MSX systems and other, complementary projects now under way in Japan offer the only well-defined approach to a standard that will let them actually do it.

Since the late 1970s, the Japanese Ministry of Posts and Telecommunications, in cooperation with the leading Japanese electronics companies that are also participating in the MSX project, has been working on "home bus" systems and standards designed to integrate local-area computer networking, two-way digital audio and video communication, and electric power all in one cable running throughout homes. The Nippon Telephone and Telegraph Corp. has been working on an Information Network System that would totally digitize communications within Japan and eliminate extra charges for long-distance calls. The target date for completion of the Information Network System is 1995 and there's a good chance that something much like the home bus system will have been implemented in at least some places a good deal before that. It's a good bet that the consumer will be able to:

- control any electrical product in any part of his house from any other part of his house;
- call up large libraries of information from his home at a

price no more expensive in real terms than a local phone call is today;

- do a significant portion of his shopping from home by computer at lower total cost than he could do it in a store;

- store large libraries of audio and video entertainment digitally on central storage media from which they can be retrieved with the touch of a few buttons;

- receive a custom-designed newspaper every day, printed automatically by his computer;

- call up the kitchen appliances from work and tell them to delay dinner if he will be late;

- run expert systems on home computers that will answer questions about subjects from home repairs to psychology at least as well as a professional counselor could by telephone;

- play the equivalent of an entire orchestra on a computer-controlled electronic organ, and

- have computers control the lights and heating system in the house to save energy (thus largely paying for the rest of the system).

Perhaps many consumers won't be able to afford the computing power to do all this, but many will. And our guess is that much of the above will be accomplishable with only a slightly greater expenditure in real terms than the consumer invests in electronics today.

Computers won't advance into homes instantly, for the same reason that every other innovation in history hasn't advanced into homes instantly: Whether it is indoor plumbing or the electric light or the telephone or television, it takes years for an industry to bring costs down, get the infrastructure in place, and bring functionality up so that a new device can truly become worthy of the consumer's spending.

Take telecommunications: Anyone who has actually tried telecommunicating for fun today after reading the hype about it in computer magazines will undoubtably have been left a bit disillusioned: On-line information costs $6 to $24 an hour or more, and much of the time on-line is often wasted by software that works poorly. But the largest share of the costs of many on-line services consists of communications charges that connect the user with a computer half a continent away, and of marketing

and administrative costs. Technology is making the cost of local computers so low that the average public library will soon be able to afford to maintain one with dozens of phone lines for public access.

Shimba of Matsushita Electric, quoted at the beginning of this study, is right: the public will want computers. And it will want computers not with an array of gimmicks but with basic functionality similar to that which is built into business computers. With that functionality, with communication that links the computer to the other appliances around the house, and with the same kind of price declines that Japanese knowhow has brought to video recorders and microwave ovens, the home computer is likely to be as transforming a product as the automobile or television. And MSX will be the initial vehicle of that transformation.

# MSX AND THE COMING REVOLUTION IN CONSUMER ELECTRONICS

CHAPTER 6

# Appendix A

# MSX Specifications

These are summary specifications. Complete specifications are available from Microsoft Inc. and from Qest Publishing. See Appendix C.

## A.1 Essential chips

- Z80A-compatible microprocessor
- 32K ROM containing system software {64K ROM expected in MSX version 2, due in late spring, 1985}
- 16K minimum user RAM (64K is the generally acknowledged minimum for the U.S. market, though some extremely low-cost machines could be sold with as little as 8K.)
- TI TMS-9918A-compatible video display processor {to be replaced in version 2 with an ASCII/Microsoft/Yamaha proprietary chip}
- 16K dedicated video RAM {expected to expand to 64K in MSX version 2}
- General Instruments AY-3-8910-compatible sound chip
- Intel i-8255-compatible programable peripherals interface
- special VLSI-based slot management system

## A.2 Display

### MSX Version 1

256x192 pixel display (it is suggested that 8 pixels on the left and 8 pixels on the right of the screen not be used by software)

16 colors

up to 40 characters per line in text mode

up to 32 sprites fully programmable in BASIC. Maximum 4 sprites on the same line.

### Expected Specifications of Version 2

256 colors.

A variety of new modes providing for substantially increased resolution and built-in 80 column capacity.

## A.3 Expansion and Memory

Address bus for Z80 is divided into 4 "slots" each of which is in turn divided into 4 "secondary slots." Except for "slot 0," which addresses the built-in memory, each "slot" in the address bus can address a physical "slot" in the machine or an external expansion unit. Each slot can then handle an external peripheral, a program on ROM cartridge, or up to 64K of random-access memory. (RAM for the video display is seperate from this total). Thus the machine can theoretically possess up to 1,024 K of RAM plus the dedicated video RAM, but in practice the total is likely to be less if external peripherals are installed.

The built-in start-up program automatically checks what is plugged into each slot and sets up the operating environment, so it doesn't matter to the user which slot he has plugged which peripheral into.

## A.4 Disk operating system

MSX-DOS attempts to be program compatible with CP/M 80 while using the data storage format, commands, and other characteristics of MS-DOS wherever possible.

In principle, 3", 3.5", 5 1/4", and 8" disks are supported; in practice it's unlikely that anything but 3.5" and 5 1/4" disks will be sold.

MSX disk drives will permit storage of as much data as IBM, Hewlett-Packard, and other industry standard drives, and will operate with comparable speed.

## A.5 Other specifications

Sound - 8 octaves, 3 voices, sound effects

Cassette tape - FSK format 1200/2400 baud. Port built into all machines - 8 pin DIN connector designed to interface with three plugs to any standard cassette recorder. Special tape recorders may be required at 2400 baud.

Joystick ports - one or two AMP 9 pin connectors generally built into machines

Printer interface supported - 8-bit parallel. For best results, printer should support all 256 characters of MSX display code. Connector is AMP 14-pin compatible.

Number of keys - 72 - different (though similar) layouts specified for Japan, North America, and Europe

BASIC - MSX version 1 built-in BASIC is an enhanced version of Microsoft BASIC very similar to IBM BASIC except for the addition of programable Sprites.

Interrupt - accepts interrupts from VDP and cartridge. System software uses 60 Hz interrupt from VDP in NTSC version and 50 Hz in PAL version. Interrupt mode is 1. Branch to 38H

Cartridge/expansion slot -- special 50-pin connector.

# Appendix B

## Translation of MSX Prospectus

On the following pages is a translation of an MSX prospectus prepared by ASCII Corp. in spring of 1984.

# MSX HOME COMPUTER
# PROSPECTUS FOR THE YEAR 1984

April 25, 1984

Microsoft Far East Headquarters
Kazuhiko Nishi

translation by
Robert Chapman Wood
Modern Economics Co.
19 Otis Rd.
Scituate MA, 02066
(617) 545-5938

## MSX Home Personal Computer

Japan

1. Casio Calculator Ltd.
2. Canon Ltd.
3. Kyocera Ltd.
4. Sanyo Electric Ltd.
5. Sharp Ltd.
6. General Ltd.
7. Sony Ltd.
8. Toshiba Ltd.
9. Nihon Gakki Ltd.
10. Nippon Electric Co. Ltd.
11. Japan Victor Co. Ltd.
12. Pioneer Ltd.
13. Hitachi Ltd.
14. Fujitsu Ltd.
15. Matsushita Electric Co. Ltd.
16. Mitsubishi Electric Co. Ltd.

(in the Japanese equivalent of alphabetical order)

So far - 150,000 units

By December 1984 - 400-500,000 units

By May 1985 - 500-700,000 units

Europe September 1984 introduction

Through April 1985 - approximately 100,000 units

## MSX Software Development

October 1983 - 20 software titles available

April 1984 - Approximately 500 titles available

December 1984 - Approximately 1000 titles available

ROM 700 Disk 300

Software market growing

New disk software market is born.

## The Five Characteristics of MSX

MSX Theme: " A : V : I : C : C "

| | |
|---|---|
| Audio | Music capability<br>GI sound chip |
| Video | Graphics capability<br>TI graphics chip |
| Interface | Interface capability<br>Joystick<br>Printer<br>Cassette |
| Computer | Computer Capability<br>Z-80 CPU<br>ROM BASIC<br>RAM |
| Communication | Communication Capability<br>RS-232<br>Cable TV<br>Modem |

## MSX Parallel Developments

| | |
|---|---|
| Home | Television |
| | Video Tape |
| | Video Disk |
| | Audio Components |
| | Digital Compact Disk |
| | Laser Disk |
| Communication | |
| | RS-232 Interface |
| | Cable television interface (under development) |
| | High speed serial interface (under development) |

## MSX Example Configurations

Y200,000 ($833)[2] - Business computer
(hard disk)

Y100,000 ($416) - Personal computer
(two floppy disk drives)

Y50,000 ($213) - Home personal computer
(1 floppy; 64K RAM)

Y30,000 ($125) - Home computer
(RAM 16K)

Y20,000 ($83) - TV game machine
(no keyboard)

---

2. All currency conversions at $1=Y240. Prices are estimated future retail prices for the Japanese market. They are about half of today's prices. Though no date is specified for when these prices will be effective, a contact at ASCII Corp. says they are expected to be achieved in the Japanese market some time in 1985.

## MSX New Media Interfaces

1. Captain[3] adapter development
2. Character adapter development[4]
3. Voice synthesis adapter
4. 21-pin standard television interface support
5. MSX personal computer modem development[5]

---

3. a Japanese videotext standard.

4. probably for Chinese characters.

5. probably standards for modems, rather than a single modem to be produced by all MSX computer manufacturers.

## 1984 Fall and Winter Positioning

1. Not only TV game, but expandable into a full personal computer:
   - 64K RAM
   - disk interface

2. Intelligent disk-based games
   - adventure games
   - war games

3. Disk-based PA (personal automation) software
   - calc
   - database
   - graph production
   - word processing

4. A smell of new media
   - Captain adapter
   - Chinese character adapter

# APPENDIX B

# Appendix C

## Sources of Further Information on MSX

The publisher of this study will attempt to provide further information on MSX developments and market potential to purchasers of this study on request.
Call or write:

Modern Economics Co.
Robert Chapman Wood, President
19 Otis Rd.
Scituate, MA, 02066
Tel. (617) 545-5938
Telex 247-316 (ARTF UR) ATTN RW
Delphi - RWOOD

Technical questions should be addressed to Microsoft Corp. or to Qest Publishing. Where support from these two sources is inadequate, Modern Economics Co. has in the past obtained answers for clients on a consulting basis by working with sources in the MSX group in the U.S. and Japan and by translating information from Japanese-language literature.

The first source for MSX technical information is Microsoft headquarters in the U.S. Contact:

Ron Hosogi
Director of Far East Business Development
Microsoft Corp.
10700 Northup Way
Bellevue, WA, 98004
Tel. (206) 828-8080

Qest Publishing is run by Steven Ting, one of the designers of MSX, and associate Merv Fong. It produces a monthly newsletter

MSX World and also sells MSX hardware, software develpment tools, and technical data books. It can help answer MSX technical questions when information from Microsoft is hard to obtain. MSX World costs $40 per year:

Qest Publishing
39 W. 32nd St.
Suite 800
New York, NY, 10001

## C.1 Hardware company contacts

The following contact people at major hardware companies associated with MSX may be helpful. However, not all of these companies are yet committed to bringing MSX machines to the U.S., so the support they provide may be limited:

Masayori Sei
Sr. Vice President
Sony Corp.
Sony Drive
Park Ridge, NJ, 07656
(201) 930-6351

Ken Shimba
Matsushita Electric USA
1 Panasonic Way
Secaucus, NJ, 07094
(201) 348-7320

Kevin Elias
New Business Coordinator
JVC U.S. Inc.
41 Slater Drive
Elmwood Park, NJ, 07407
(201) 794-3900

Donna Ventemillia
John Talbot
Pioneer Video U.S.A.

200 West Grand Ave.
Montvale, NJ, 07645
(201) 573-1122

Phil Moon
Yamaha USA
PO Box 6600
Buena Park, CA, 90622
(714) 522-9262

Roy Tiampoli
marketing manager
NEC Home Electronics
(312) 228-5900

Rod Cole
vice president, marketing
Progressive Computer Products
11285E Sunrise Gold Circle
Rancho Cordoba, CA, 95670

Kazuya Hanazuka
Hitachi USA
(914) 332-5800

# Index