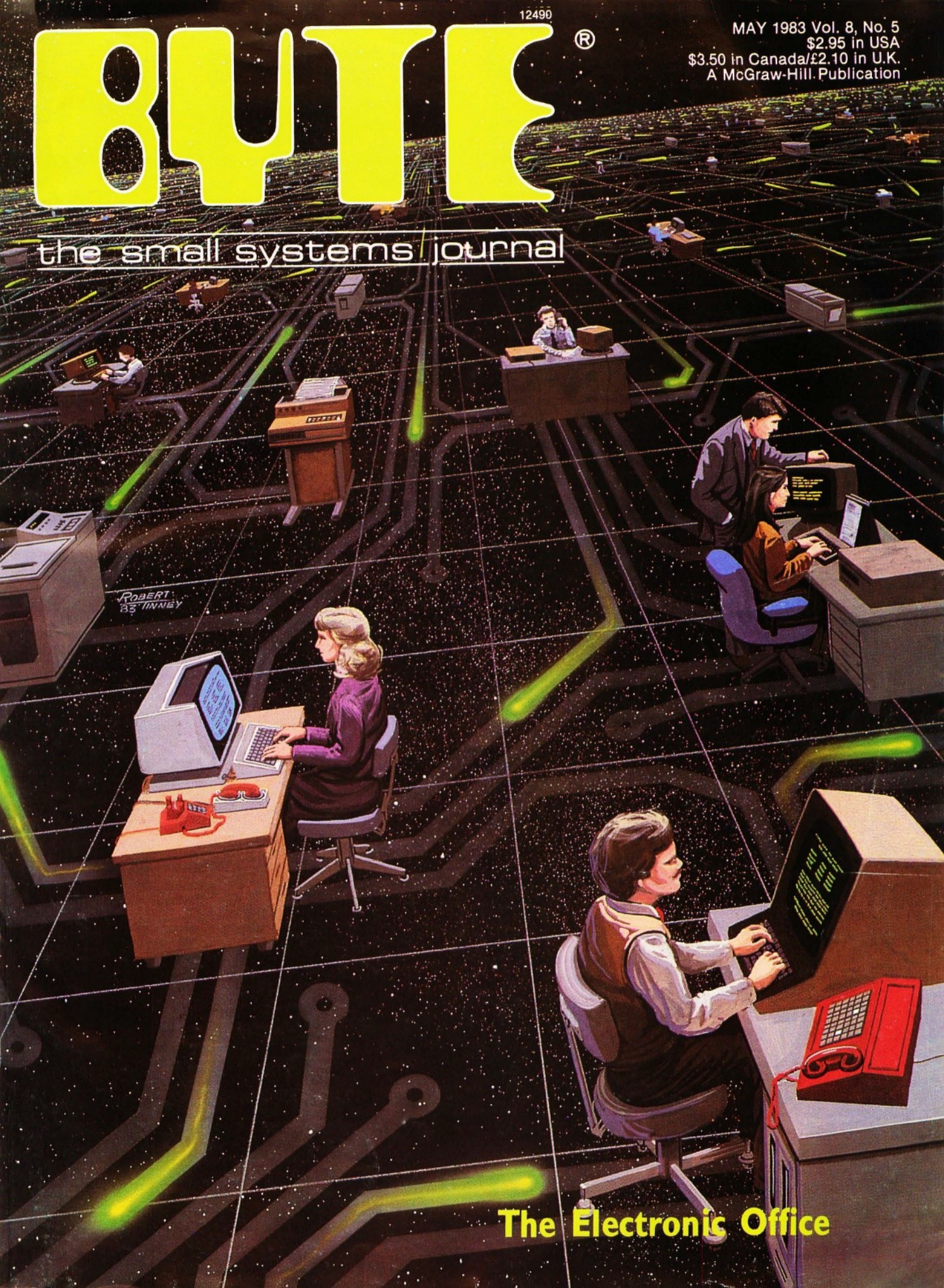


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The Electronic Office

Stalking the East-Asian Microcomputer

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Although the products of Asia's modern technologies do not yet rival its ancient treasures, they soon will. The five-nation Far East Electronics Tour in October and November 1982 delivered this message to one group of Americans through a series of six electronics trade shows: the Japan Data Show and the Japan Electronics Show (both covered in the first part of this article, "New Japanese Microcomputers," April BYTE 1983, page 110), the Korea Electronics Show, the Taiwan Electronics Show, the Hong Kong Consumer Electronics Show, and China Comm 1982, in Beijing. Firms in all these countries except China manufacture microcomputers of local design.

The first stop on the tour was Japan, where the trade shows exhibited the most significant new microcomputers and where a remarkable Tokyo neighborhood showcases the vigor of the domestic Japanese microcomputer market. The rest of the tour revealed interesting developments in the other countries as well. (For those who are thinking of joining the 1983 Far East Electronics Tour, the organizer is Commerce Tours International, 870 Market St., San Francisco, CA 94102, telephone (415) 433-3072.)



Photo 1: Yamagiwa Tecnica, a six-floor store in Akihabara, Tokyo, sells only microcomputers and associated products.

Akihabara, Tokyo, Japan

If the object is electronics, then every tour of Asia should begin and end in Akihabara. This remarkable neighborhood in Tokyo is as interesting as the Japanese electronics shows. Akihabara (pronounced with the accent on the third syllable) covers an area of several square blocks. More than 400 electronic shops of varying size are packed into buildings about five to eight stories high. Escalators take you from the middle of one shop and drop you into the middle of another. There are

probably more shops selling microcomputers and related products in Akihabara than in any other neighborhood in the world, except perhaps in Osaka, the great industrial city that boasts a neighborhood called Nipponbashi said to rival Akihabara.

Many scenes in Akihabara strike the Western eye as improbable: a man riding a bicycle with an NEC PC-9801 16-bit computer strapped on the back fender; a shop with bins full of a remarkable hybrid device, a combination electronic calculator and mechanical abacus; integrated-circuit shops packed with customers of all ages and pocket-books standing side by side poring over the latest chips; a



Photo 2: A no-frills electronics store in Akihabara.



Photo 3: Typical Akihabara store display.



Photo 4: The Samsung SPC-1000 Z80A-based home computer from Korea.



Photo 5: The thronged exhibit booth of the Multitech Industrial Corporation at the Taiwan Electronics Show.

storefront full of oscilloscopes and logic analyzers arranged to grab the eyes of potential customers.

Some of Akihabara's larger stores sell all kinds of Japanese-made electronics—audio, video, music, home appliances. Each devotes an entire department to microcomputers; often a whole floor is packed with machines from most of the major Japanese manufacturers.

Some large stores—notably Yama-giwa Tecnica, shown in photo 1—sell microcomputers only. Yamagiwa Tecnica has six floors: one devoted to software, another to home computers, another to more powerful computers (mostly 16-bit), word processors, and so on. The one-floor NEC Bit-Inn has nothing but NEC machines ranging from the PC-2001 hand-held computer to the N5200 (known in the U.S. as the Advanced Personal Computer) and the PC-9801, both 16-bit computers. Expansion boards and accessories for these computers are in stock. Another store, shown in photo 2, offers no frills but good prices on boxed computer products, mostly from NEC. Customers walk where they can, mostly behind the rows of boxes. Typically, the interiors of the retail computer stores are packed with equipment on display. Photo 3 shows a section of a typical store interior.

Many small stores in Akihabara specialize in various kinds of components. One storefront devoted to semiconductors was selling 64K-bit dynamic RAM chips at 8 for 9000 yen, or about \$4.25 per chip. (The lowest price I've seen in this country is \$5.50 per chip, from a mail-order firm.) Customers had the choice of NEC, Mitsubishi, or Toshiba RAMs. The man behind the counter complained that 64K-bit RAMs were in short supply, which led me to believe that the prices were probably no lower than usual. Another small shop sold disk drives, power supplies, single-board computers, circuit cabinets, and the like.

Many of us foreign shoppers were concerned about the reliability of these low-priced goods. Were we being offered factory rejects? A Japanese businessman allayed our fears, saying there was no need to worry about getting defective goods in Akihabara. If a

Japanese electronics manufacturer discovered that defective goods bearing its name were being sold by any shop, the company would never again deal with that shop. In effect, the manufacturers police the retail trade.

The neighborhood was so much like a bazaar that I found the impulse to haggle irresistible. But I was worried: Would haggling be possible when I spoke no Japanese and the shopkeeper spoke almost no English? Would the concept of bargaining be clear? Would the shopkeeper find bargaining offensive? Could he recognize the English words for numbers? At last I ventured to ask, "Discount?"

The shopkeeper replied, "Target price?" and handed me a pad and pencil. The list price was 120,000 yen, then worth about \$450. I wrote,

A NEC memory board costs \$700 in the United States but sells for \$362 in Akihabara.

"90,000." The shopkeeper laughed pleasantly and wrote, "100,000." We soon reached agreement on a price of 96,000 yen. A NEC memory board for the Advanced Personal Computer with a list price in the United States of \$700 then changed hands in Akihabara for only \$362.

The flourishing electronics industry that makes Akihabara possible has in part resulted from efforts of the Ministry of International Trade and Industry (MITI). Because MITI's Industrial Electronics Division funds research, some Americans have charged that Japan's electronics manufacturers enjoy an unfair advantage in competing with American manufacturers. Toshio Takai, who worked in MITI for 25 years before becoming executive vice-president of the Electronic Industries Association of Japan, denies the charge. He says, "MITI funds only basic research, and MITI's research money cannot be used for development of commercial products." Takai also points out that there is nothing to stop the government of the United States from funding research in electronics as MITI does in Japan.

Seoul, Korea

Our introduction to the Korea Electronics Show was unlike what we encountered elsewhere on our journey. As my group arrived at the trade center, we saw dozens of black sedans that formed a semicircular barricade in front of the exhibition hall. Perhaps a hundred men in dark business suits, some holding handguns, arrayed themselves behind the barricade. All the Koreans who approached the exhibition hall were stopped by these guards, but Westerners could pass through. In addition to the guards, the only Koreans inside the barricade were old women stooping over crude short-handled brooms, sweeping every speck of dust from a wide path leading to the entrance of the hall. As we watched, several more black sedans arrived and passed through the barricade to park in the protected semicircle. More guards emerged from the newly arrived cars. All the guards now appeared poised for action, their eyes watchful. One guard opened the rear door of a car and out stepped a lone man in a dark business suit. All eyes followed that lone man as he walked down the clean-swept path and disappeared into the hall. "The President," someone said.

Inside, exhibits of consumer electronics and components and a few Korean microcomputers vied for our attention. Photo 4 shows the Samsung SPC-1000 home computer, a Z80A-based machine with a 32K-byte ROM containing Samsung-HuBASIC, 70K bytes of RAM, a music and sound generator, and an audio cassette built in for mass storage. Samsung also makes the Samsung Personal Computer, the SPC-2000. It is a 64K-byte CP/M-based system with dual 5¼-inch floppy disks, a detached keyboard with programmable keys, and a video monitor that tilts and swivels. Gold Star, Taihan, DMS, Trigem Computer, and a few other companies also displayed microcomputers.

The Trigem 20 is a 64K-byte Apple look-alike with a 12K-byte BASIC in ROM (read-only memory). The Trigem 20 has sound and color-graphics capabilities, game input/output, and eight empty expansion slots as standard equipment. Company spokes-

The Japanese Microcomputer Marketplace

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Over the past four years Japanese microcomputer manufacturers have seen their share of Japan's domestic market increase from 10 to 75 percent. Clearly, advances in technology and marketing techniques make this the market to watch throughout the decade.

Almost every Japanese electronics company, large and small, is in the personal computer business. Fierce competition is seen in all price ranges as each firm attempts to carve its own market niche. A great boon to consumers, the lively market is producing microcomputers that come fully equipped with features hardly imaginable just a few years ago when Apple and Radio Shack dominated the Japanese market. By following the competition's footsteps, the Japanese are able to offer compatibility with existing hardware and software plus improvements in reliability, service, features, and price. As an added advantage, many companies supply themselves with semiconductor chips and have their own well-established distribution networks.

Today's typical Japanese microcomputer usually has a Z80 microprocessor and offers a variety of standard features such as separate numeric keyboards, programmable function keys, selectable 40- or 80-character displays

and Japanese or graphics character sets. Each company tries to include a feature in its machine that sets it apart from the competition. For example, some of the newer VLSI chips like the 64K-bit RAMs are appearing in many computers. Additional features seen recently include bubble memory, plug-in ROM packs, built-in terminal functions, and Japanese character sets with 3000-7000 characters. The 16-bit microprocessors are generating a lot of excitement as well. The 8088 appears to be winning the 16-bit popularity contest. One of the earlier 8-bit systems already offers an 8088 plug-in card.

Traditional excellence in miniaturization is evident in the current crop of Japanese pocket and portable computers. Even though the Japanese have little outside competition, the domestic market is characterized by fierce scrambling.

A move toward office automation is keeping the domestic microcomputer market booming. Despite the initial high cost of dedicated word-processing systems (around \$12,000), they quickly became essential office equipment. These word processors use one of several methods to enter and manipulate the Japanese language, which consists of two syllabaries, or kana, and thousands of individual characters. One entry method uses a board with several thousand characters printed on it. A stylus helps the user select the characters to enter. A more popular method uses a keyboard with the syllabaries. Using about 50 characters only, this method is easily im-

plemented on a qwerty-style keyboard. The user simply types the symbols for the sound of a character and then presses a button. The machine decodes the input and produces a character. Most systems can even determine the character you want from the context in which it's being used. This capability is essential with a language in which many characters have the same sound. These word-processing systems are usually sold complete with dot-matrix printers (24 by 24 dots) that produce good-quality printouts. Hardware and software advances have brought the prices for these systems down to around \$3000 and the low cost is a factor in the growing strength of the domestic market.

The Software Scene

While Japanese hardware distinguishes itself with special advanced features, several problems plague the software development effort.

With the two syllabaries and thousands of characters, the Japanese language is much more difficult than English to manipulate electronically. Few of the current microcomputers can easily be used for word processing, although some progress is evident. Another factor in the software industry's slow growth is that use of disk drives is not as widespread as it is in the U.S. This places a severe limitation on the type of software that can be marketed to a wide audience. Additionally, the use of computers in business applications lags far behind that in the United States. Electronic spreadsheets such as Visicalc are having an effect on the use of microcomputers in Japan, but this is a recent development.

Availability of software is another important issue. The number of domestic private software houses remains small and premium prices are charged for imported software—usually a 100 percent markup over the U.S. list price. However, the situation could

About the Author

Kurt Veggeberg worked for four years as the director of the Information Center at Nagoya University of Commerce in Nagoya, Japan. He is presently working on an MBA at the University of Texas.

men say that the Trigem 20 differs from the Apple II in the video color signals, ROM software, and power supply. According to Trigem, the government of Korea is distributing 5000 microcomputers to the country's high schools, 1000 of which will be Trigem 20s. The export price of the Trigem 20 is \$350 in quantities of

3000, with a 9-inch green-phosphor video monitor selling for \$68 in the same quantities.

The Korean electronics industry developed rapidly, and by 1981 consisted of almost 800 companies employing 270,000 people. Two-thirds of the \$3.8 billion annual production is components, with another one-fifth

devoted to consumer electronics. The Korea Institute of Electronics Technology and the Korea Electro-technology and Telecommunications Research Institute have concentrated on digesting and improving imported technologies. The Electronic Industries Association of Korea expects these research institutes to generate advanced technol-

change soon because most Japanese microcomputer manufacturers are concentrating their efforts on standard operating systems. This should encourage the development of software in Japan and also encourage the importation of American software with a corresponding increase in the exportation of Japanese hardware.

Both production and distribution of software are rapidly becoming part of the book publishing domain. Simple cassette programs appear alongside magazines and other printed materials in bookstores across Japan. Most of the stores provide microcomputers so potential software buyers can try programs before purchasing. As you might expect, this attracts a lot of attention and so far I have been unable to push past the children to try any programs myself.

Intense Interest

The Japanese express a great deal of interest in microcomputers and appear to be welcoming them into their lives. A current television series on microcomputer programming is aimed at beginners and more conventional instruction is offered in a variety of places from computer stores to private schools. These courses target every possible group of future computer users. Japanese computer magazines reflect the growing demand for computer information with their multiplying numbers and rapid increases in size.

Although the Japanese have not yet made a strong showing in American markets, they're fully aware of the potential for profit in the U.S. Japanese domestic products are well designed and competitively priced and their success with low-cost printers and video displays indicates their ability to play a strong role in the American personal computer market. While this competition may bring difficulties for manufacturers, the benefits for end users should be plentiful. ■

ogies for integrated circuits, computers, and telecommunications. One goal mentioned at the electronics show is to produce 64K-bit dynamic RAM chips in 1984 using home-grown technology.

Taipei, Taiwan

The Taiwan Electronics Show, held

at the China External Trade Development Council Exhibition Complex in Taipei, had 511 exhibitors. While most products displayed were consumer electronics or components, I saw a lot of computer products too.

The most common microcomputers made in Taiwan are blatant copies of the Apple II. Also shown were an apparent copy of the Radio Shack TRS-80 Color Computer and two copies of the Osborne 1. An Osborne 1 copy called the Datatree Portable Business Computer had a 9-inch screen, two double-density floppy-disk drives, and all the software usually bundled with the Osborne 1; this machine cost \$800. The second Osborne-like portable, made by GRE Rong Electronics, includes a 6502 processor, as well as a Z80, and claims compatibility with both the Apple II and the Osborne 1.

I didn't get to see, as promised, a third Osborne look-alike. Its designer refused to bring his prototype to the Taiwan Electronics Show and insisted on a private meeting with me miles away at the office of one of his friends. When the designer arrived, more than an hour late, his appearance presented quite a contrast to the usual conservatively dressed Taiwan businessman. Half-inch-long white stitches left me no doubt about how his purple suit was put together. His purple and orange floral print shirt and inch-wide white polkadots in his purple tie set up a high-frequency oscillation with the seams of the suit.

Under the circumstances, there was real danger of my overlooking the business of the meeting. But, I asked, "Where's your Osborne look-alike?"

His eyes shifted from place to place as if looking for assassins. "If anyone saw it," he said earnestly, "they might copy my design."

If it happened to Adam Osborne, it could happen to him.

Some businessmen on the island explain the epidemic of Apple II copies as a response to the Nationalist Chinese government's ban of video games. Many companies in Taiwan had bought great quantities of discrete logic circuits and 6502 microprocessors in preparation for an expected boom in the game-machine market.

The government's ban left these companies with huge inventories of chips useful for building Apples. That might explain the Apple copies, but what about the bastard Osbornes?

Because U.S. Customs officials are watching for products from Taiwan that infringe upon American patents and copyrights, Americans would be ill-advised to rush off to Taipei to pick up a \$245 Apple or an \$800 Osborne clone. Furthermore, some local insiders told me during the show that many electronics firms in Taiwan are pushing the government there to ban the export of these illicit products. Many in Taiwan believe that copyright and patent infringements in electronics damage the reputation of the entire electronics industry in the Republic of China and injure the island nation's trade. Despite great economic advantages, some foreign companies are reluctant to manufacture in Taiwan for fear that designs will be copied by local entrepreneurs and sold on the open market at unbeatable prices.

Some respectable Taiwan firms that make legal Apple-compatible products are tired of having to defend themselves against charges inspired by illicit Apple-clones made by other firms. For instance, Stan Shih's Multitech Industrial Corporation produces the successful and lawful 6502-based Micro-Professor II, and Shih is incensed when people call that compact machine a copy of the Apple. The Micro-Professor II packs 64K bytes of RAM and a 16K-byte ROM BASIC into a unit slightly larger than an average modem. The computer will execute most Apple II software because its own software uses system calls compatible with those in the Apple's operating system. Priced in Taiwan at around \$200, the Micro-Professor II is not an imitation of an Apple but an improvement on it. The Micro-Professor II accepts software cartridges as well as audio-cassette-based software (the audio recorder and a disk-drive controller are optional). According to Shih, the Multitech BASIC interpreter has 90 instructions more than Applesoft BASIC.

Micro-Professor II has enjoyed great success in Taiwan (see the thronged

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Multitech show booth in photo 5) not only because of its compactness and low price, but also because of its optional Chinese character controller (CCC). The Z80-based CCC adds another 64K bytes of ROM and 2K bytes of RAM to the little Micro-Professor II, and gives the user access to 22,000 Chinese characters, each displayed in a 16 by 16 matrix. With the CCC installed, the Micro-Professor permits the user to enter BASIC programs in either Chinese or English. Multitech recently remedied the only obvious deficiency of Micro-Professor II—its small keyboard—by offering a full-size typewriter keyboard as an inexpensive option. The optional keyboard has cursor keys and two "fire" keys, the latter for games. At least one member of the Far East Electronics Tour left Taiwan with a Micro-Professor II in his luggage.

Multitech now has more than 250 employees and annual revenues of \$20 million. The company's future products will include a portable computer.

Tony Jwang of J. E. Computer Company says that the only way for Taiwan's microcomputer companies to survive is to stop copying foreign machines and design their own. However, J. E. Computer now produces computers compatible with the Radio Shack TRS-80 Color Computer and the Apple II.

Taiwan's answer to Japan's MITI is ERSO, the Electronics Research and Service Organization of the Taiwan Industrial Technological Research Institute. Since 1974, ERSO has been transferring electronics technologies to local industry. ERSO develops electronic products more advanced than those of local industry and then assigns the manufacturing rights to a private Taiwan company. Recent ERSO products include the EMB86/01, an 8086-based single-board computer for the Multibus. ERSO also developed the BC-1000, a multiuser Z80A-based computer running the MP/M multiuser operating system, and turned manufacturing and marketing over to PECOR (President Enterprises Corporation), a private company in Taipei. ERSO's highest priorities now include development by 1984 of VLSI (very large-scale integra-

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tion) technology capable of producing 64K-bit RAMs and development of microcomputers and minicomputers. One of ERSO's goals is to foster the computerization of Taiwan.

Hong Kong

The Hong Kong Consumer Electronics Show revealed several microcomputers made locally. Video Technology makes two home computers. The Creativision uses a 6502A microprocessor running at 2 MHz and has 16K bytes of user RAM and a 12K-byte BASIC in ROM. The system serves as a game machine as well as a computer. The compact VZ100 Personal Computer has a Z80A running at 3.58 MHz, up to 35K bytes of RAM, 8K bytes of ROM containing system software and a BASIC interpreter, and a 45-key rubber keyboard.

Eaca International Ltd. has been making microcomputers in Hong Kong since 1979. The product line includes four different Z80-based microcomputers, the Genies I through IV. The Genie III is an all-in-one desktop computer that has a 4-MHz Z80A, 64K bytes of RAM, two 5¼-inch floppy-disk drives, and runs CP/M version 2.2. Two exhibitors in the Hong Kong Consumer Electronics Show said that the Crown Colony has set a goal of becoming a net exporter of computers by 1985.

Beijing, China

For the 20 members of the American Electronics Association trade mission to Beijing, the Chinese capital held several surprises. The first was the Chinese-language NEC PC-8001B used behind the desk at the Yanjing Hotel. The second was the amount of attention devoted to the trade mission by officials of the Fourth Ministry of Machine Building of the People's Republic of China, also known as the Ministry of the Electronics Industry. Three representatives, Huang Zhao Ming (seen in the dark gray coat at center in photo 6), president of the China Electronics Import and Export Corporation (CEIEC), and Li De Guang and Sun Shunxing, respectively vice-president of the corporation and director of the corporation's Department of Trade Relations, met with

members of the trade mission for several hours.

While some discussions centered on the particular trading interests of the members of the trade mission, the Chinese emphasized their desire for the relaxation of export restrictions on American technology. At dinner one

Handley briefed the trade mission on the current state of electronics in China: "The Chinese electronics industry is still working in the late 1960s or early 1970s. They have a few research institutes that can produce a few advanced semiconductors. They make a few microprocessors."



Photo 6: The American Electronics Association trade mission met with representatives of the People's Republic of China Electronics Import and Export Corporation (CEIEC), including its president, Huang Zhao Ming (in dark gray coat at center).

night at Beijing's International Club, the tour members joined the Chinese officials in repeated moutai toasts to the easing of restrictions on LSI and VLSI technology. (Moutai looks like vodka and tastes like death.) To date, the United States government has turned down export licenses for all integrated-circuit technology more complex than that of 2K-bit RAMs.

According to Peter Handley, a commercial officer in the United States Embassy in Beijing, CEIEC has in recent years imported about \$160 million in electronic equipment annually, including computers from Hewlett-Packard, DEC, IBM, Apple, Intel, and Cromemco. Photo 7 shows the crowded Osborne Computer booth at China Comm 1982, an exhibition of Western communications and computer equipment. The Stalin-Gothic-architecture Beijing Exhibition Center was packed with Chinese visitors; the only free space was inside the booths, as shown in Hewlett-Packard's large and popular booth (see photo 8). Other exhibitors included California Computer Products, Burroughs, Cromemco, Honeywell, IBM, Perkin-Elmer, Prime, and Wang.

CEIEC prefers importing entire production lines rather than products. France recently sold China a complete plant for making minicomputers, magnetic disks, and printers. Four Japanese firms have sold China complete production lines for electronic components. West Germany and the United Kingdom have made similar deals. In the past two years, the United States has sold China only one electronics factory, valued at \$8 million.

Handley says that China's main goals for electronics imports are field-effect transistors, acoustic wave filters, integrated circuits and LSI manufacturing equipment, magnetic recording heads, and satellite earth stations. China wants to buy 15 satellites and the technology required for manufacturing its own.

The CEIEC arranged a tour for our group of the Beijing Wire Communications Factory, which makes telephone exchanges and 32-bit and 48-bit minicomputers. Photo 9 shows the front panel of one of these minicomputers. The 32-bit machine comes with 64K bytes of RAM; the 48-bit machine has 32K bytes of RAM expandable to 128K bytes and runs FOR-



Photo 7: Osborne Computer Corporation's booth at China Comm 1982 was crowded with computer enthusiasts.



Photo 8: It was standing room only at China Comm 1982. The only free space was inside the booths, such as Hewlett-Packard's, shown here.

TRAN, ALGOL, and BASIC. The factory has been working in cooperation with Honeywell for about a year and several of its staff members are currently living in Minnesota for training.

Many members of the tour were surprised by the level of poverty in the Chinese capital. Since no one has refrigeration, in late fall the Chinese pile bok choi (Chinese cabbage) high in vacant lots and on roofs and balconies in the hope that nature will preserve it as the only green vegetable for the winter months. Everywhere men and women are engaged in brute, physical labor, and the sight of a woman pulling a cart full of rocks or bricks is all too common.

China is seeking to quadruple its annual industrial and agricultural output by the year 2000. During the trade mission's visit, the English-language *Beijing Review* quoted Premier Zhao Ziyang as saying that meeting the country's production goals depends on progress in science and technology. To quote that publication:

Addressing a national science and technology awards conference held in late October, Premier Zhao specified a guiding principle for China's economic construction: develop science and technology in order to boost the national economy. He said that every department engaged in national economy must stress achieving technical progress so as to gradually shift production to a new technological basis.

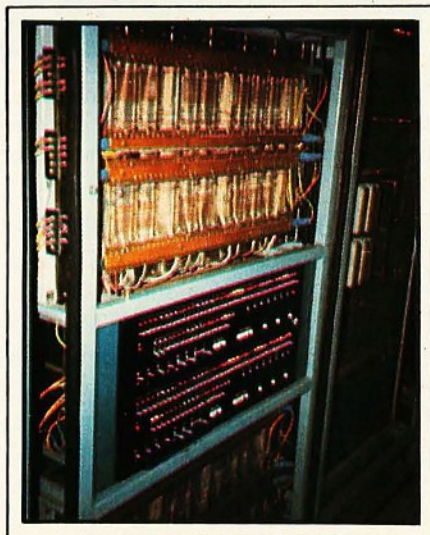


Photo 9: Front panel of a 32-bit minicomputer made at the Beijing Wire Communications Factory.

Zhao went on to say that building new factories would not be enough; old factories must be technically transformed as well. In the same issue of the *Beijing Review* (November 1, 1982, volume 25, number 44), Hi Qiamou, honorary president of the Chinese Academy of Social Sciences, was reported to have endorsed the maxim "Let a hundred flowers blossom and a hundred schools of thought contend" in scientific and cultural work.

During the trade mission's days in Beijing, the Chinese made no effort to hide the backwardness of their indus-

try; instead, they appealed for help. Most members of the trade mission felt sympathy and expressed hope for wider trade, but a few raised concerns about possible military uses of microprocessor technology if the Chinese leaders once again come to regard the United States as an arch-enemy.

The impression of centralized power is so forceful in Beijing that I believe no action by the Chinese government can be ruled out. The Chinese tour guide denounced the emperors for denying the common people even the right to use colors other than gray and dark blue, reserving brighter colors for the nobility and yellow for the emperor alone. But almost all the people of Beijing still wear gray or dark blue. When the guide pointed out the building from which the premier now governs the People's Republic, Americans noticed that the roof is the same yellow as the tiles on the roof of the Imperial Palace. Americans can hardly predict the ultimate uses of microprocessors in a land that still thinks in such terms. ■

For background information on the Japanese microcomputer industry see "The Japanese Computer Invasion" by Stan Miastkowski, August 1981 BYTE, page 200. The May 1982 issue of BYTE also contains several articles on Japanese microcomputers, the state of the industry, and the manufacturers themselves.