By Simson Garfinkel

THE STORY BEHIND THE HIGH PRICE OF DRAMs

It's no secret that DRAMs are in short supply. Why and for how long?

I was rudely awakened to the high cost of DRAM (dynamic random access memory) chips recently when I went to buy a motherboard for a personal computer I'm building. The XT-class motherboard cost $119. The memory for the motherboard now costs $300. A year ago, it would have cost $50.

High-capacity DRAM chips are used to store information in virtually every computer manufactured today. The two most popular sizes are the 256-kilobit (256K) chip and the one-megabit chip (1Mb). The 1Mb chip can store the equivalent of 635 typed pages, although the chips are often used in groups of 16 or 32 in modern computers.

Chips that two years ago cost $2 now cost between $15 and $18. But the real problem, according to industry representatives, isn't the high cost, but the uncertainty in the supply of the chips themselves, at any price.

Hewlett-Packard, for example, planned to introduce an 80386 version of its Vectra portable computer this summer. The computer was not introduced, "because we're not able to obtain a supply of DRAMs to cover both the new product and existing products," says Gene Endicott, a company spokesman.

The shortage isn't likely to subside until the middle of 1989 at the earliest. To understand why, let's return to 1984, when the semiconductor industry was in the throes of another DRAM shortage, this time with 64K chips.

In January 1984, when most IBM PCs held 64K of memory, and 640K was more than anybody could possibly need, there simply weren't enough memory chips to go around, says Joanne Locke, director of communications for the Semiconductor Manufacturers' Association (SMA). The chip-making industry, in both the United States and abroad, responded to the shortage by building more semiconductor fabrication capacity.

The Japanese built a lot—many analysts say too much. By mid-1985, the availability of DRAMs had surged, and their prices tumbled. Chips that had cost $5 suddenly cost 25 cents.

American businesses argued that the prices were being pushed down not only by oversupply, but because the Japanese were selling the chips below their manufacturing costs—a practice called dumping. The idea, the Americans charged, was for the Japanese to capture semiconductor market share by pushing American firms out of the business; then the Japanese companies would be free to raise prices.

The United States Department of Commerce (DOC) began an investigation and, on April 21, 1985, issued a final determination that Japanese chip makers were in fact dumping 64K DRAMs on U.S. markets. On March 15, 1986, the DOC issued a preliminary determination that 256K DRAMs and high-capacity EPROMs (erasable, programmable read only memories) were being sold in the U.S. "at less than fair market value."

The final determination was never made on the 256K DRAMs. Instead, the DOC and the Government of Japan reached an agreement to set minimum fair market prices for the chips. The so-called Semiconductor Agreement was signed on September 2, 1986. Other terms of the agreement were that the Japanese would stop dumping in third-party countries, such as Singapore and Korea (where the chips were incorporated into low-priced computers, which were then shipped to the United States), and that the Japanese would open up their markets to U.S. chip manufacturers.

But it was nearly a year too late. By the end of 1985, five of the seven U.S. chip manufacturers who sold high-capacity DRAMs—Mostek, Intel, Motorola, National Semiconductor, and AMD—left the business, leaving Texas Instruments and Micron Technology as the only American sources for the chips. (Although both IBM and

Simson Garfinkel is a freelance journalist and computer consultant living in Somerville, Mass.

AT&T manufacture DRAMs, both companies use the chips only for their own computers.)

"We should have gone out of business too," says a spokesperson for Micron. "The Japanese started dumping, so we couldn't sell above our costs. Other companies stopped making them because they had other products." Those same companies are not reentering the market now for fear of being burned again.

Despite the Semiconductor Agreement, the Japanese manufacturers continued dumping in third-party countries and kept their markets virtually closed to American chips, according to a DOC spokesperson. In April 1987, President Reagan declared "that the Government of Japan has not implemented or enforced major provisions of the Arrangement concerning Trade in Semiconductor Products." He imposed additional sanctions in the form of tariffs on a variety of products, including hard disk drives, 16- to 64-bit CPUs, computer monitors, and computer tape.

Since then, many of the sanctions have been lifted. The few that remain, according to the Department of Commerce, are in place because the Japanese have still not opened up their markets to U.S. chips. The trade agreement had called for U.S. chip makers to have a 20-percent market share of the Japanese electronics industry; currently they have a 10-percent market share, and the percentage is falling.

So why today's DRAM shortage?

After the signing of the September agreement, rumors circulated that the Japanese Ministry of International Trade and Industry had ordered DRAM shipments to be halted to "empty the pipeline." Once the initial shortage was created, MITI instituted production limitations, quotas, and minimum prices for the chips. The Americans had specifically asked that production limitations and quotas not be the mechanism by which the agreement be implemented. Although MITI has denied such tactics, many in the United States—including people at DOC and SMA—believe that they were in place.

A second factor in the DRAM shortage is the retooling of manufacturing plants from 256K DRAMs to one-megabit chips. The one-megabit chips are much harder to produce in high yields than anybody anticipated, SMA's Locke says. So the production lines aren't making 256K chips, and they aren't making enough of the one-megabit chips.

> By mid-1985, the availability of DRAMs had surged, and their prices tumbled.

But most important, according to Joe Parkinson, chief executive officer and chairman of the Board of Micron Technology, is the fact that the Japanese companies drove their American competitors out of business in 1985, cutting the supply by at least 20 percent.

At the same time of tightened supply, demand for DRAMs has steadily increased. July 1988 marked the 19th consecutive month of growth for the computer industry, according to SMA figures. New computers need memory, and virtually every generation of computers has needed more memory than the preceding one. Applications in use today require more memory than similar applications did five years ago.

Take, for example, wordprocessing applications: The original *Wordstar* program could run on an eight-bit microcomputer with 48K of memory. Today, *Wordstar Professional Release 4* requires 256K of memory to run on a 16-bit microcomputer. Beyond simple word processing, many artificial intelligence applications are simply not possible with less memory.

Higher DRAM costs mean more expensive computers. In June 1988, Digital announced that it was increasing the average prices of its computers by 3.5 percent to pay for the more expensive DRAMs. But the kicker is memory expansion systems, the prices of which Digital increased by a whopping 35 percent.

Where does this leave the computer consumer? With high prices for DRAMs and the delayed introduction of memory-intensive products until the middle of 1989 at the earliest.

"The 256K DRAM is still going to be a big problem, because there aren't many companies willing to increase the production of 256K DRAMs, and the Japanese are getting out of that market," says Victor Didios, a spokesman for Dataquest, a marketing research company that studies the semiconductor field.

"The companies are limited in capacity, and they have to make a choice. They'd rather build the one-megabit than the 256K," Didios says.

Since OS/2 requires at least 2.5 megabytes of memory to do anything meaningful, expect further delays in the widespread acceptance of OS/2 applications and the further strengthening of the DOS and Xenix markets. (Xenix is a Unix operating system that runs on the 286 and 386 computers and, by all accounts, requires less memory than OS/2.)

And when will the price come down?

"That's the question of the hour," says Micron Technology's Joe Parkinson. "Everyone would like to know down to the day, hour, minute, second, and nano-second."

Parkinson stressed that it was more important for American manufacturers to develop long-term strategic partnerships with their suppliers, rather than hunt around for the lowest spot-market prices. For companies that do so, Parkinson said, there never has been a shortage and there won't be one in the future.

Robert Masson, hardware product manager for Convex Computers, a company whose supercomputers can carry up to eight 256-megabyte memory boards, echoes Parkinson's words. "You find a particular vendor that is most favored, and you become business partners with them," Masson said. "While it has the effect that you may end up paying more in the good times than you should, you will also make it through the bad times." Despite the tremendous memory requirements of its computers, Masson says, Convex has never had a problem securing chips.

What's needed now is for American chip-makers to reenter the market, and for American computer manufacturers to buy American chips, if at all possible. Although American chip-makers have been burned badly once, the combination of the currently high demand, the Semiconductor Agreement, and a more vigilant Department of Commerce will hopefully protect this industry in the future.