

Chuck Peddle

Chief Designer of the Victor 9000

A candid discussion on microcomputer design, marketing, and the industry's future.

Phil Lemmons
West Coast Editor

More than any other person, Chuck Peddle deserves to be called the founder of the personal computer industry. After getting a bachelor of science degree in engineering physics in 1959, he worked for 11 years for General Electric in all aspects of its computer enterprises. In 1970, Peddle started a company to make intelligent terminals. "Too early," he now says. He started a word-processing company in 1972. "Too early," he now says. He then went to work for Motorola, where he participated in the design of the 6800 microprocessor family. Peddle did the architecture for all the peripheral chips of the 6800 and all the I/O (input/output) structure. The 6820, a peripheral interface adapter (a parallel I/O chip), secured several fundamental patents in that area.

Peddle took a team from Motorola to MOS Technology in 1974 to do a low-cost microprocessor and was chief architect in the design of the 6502 microprocessor and its family of chips. By producing the 6502 and selling it for only \$25 while other semiconductor houses were saying the price would never fall below \$200, Peddle made the personal computer possible.

The 6522, the PIA (peripheral in-

terface adapter) in the 6502 family, extends the concepts in the 6820 by adding some integral timers and shifters as well as other features. The 6522 appears in several places in the Victor 9000 (see "Victor Victorious," page 216 of this issue).

MOS sold 6502s to Atari and Steve Jobs, and then Commodore bought MOS Technology. Peddle transferred to the West Coast and started Commodore's systems business. At Commodore, Peddle developed the world's first personal computer, which he designed to Radio Shack's specifications. In January 1977, Peddle showed the first PET to Radio Shack at the Consumer Electronics Show. Radio Shack and Commodore were unable to make a deal. Radio Shack did its own microcomputer, Commodore brought out the PET, and Steve Wozniak made the 6502-based Apple II. The PET and the Apple II were simultaneously announced to the public in 1977 at the West Coast Computer Faire. Apple shipped Apples first, but Commodore showed the PET first.

Peddle has since left Commodore, founded Sirius Systems Technology, and designed the machine sold in North America as the Victor 9000 and

elsewhere as both the Victor 9000 and the Sirius 1. BYTE's West Coast editor, Phil Lemmons, interviewed Peddle late in July 1982 about his goals in designing the Victor 9000/Sirius 1 and about the direction of the microcomputer industry in the next few years.

PL What were your general goals in designing the Victor 9000/Sirius 1?

Peddle I think there were three generations of microcomputer products. The first generation was the board-level computer, like the KIM-1, which was the thing that we did at MOS Technology, the Apple I, the Systems Group—that kind of computer. They were really hobby computers, meant to be used by people looking to develop computer skills.

The second generation—the PET, the Apple II, the TRS-80—were designed as stand-alone, plug-'em-in-and-they-work computers for people who wanted to have computers of their own, for whatever reason. The evolution of that kind of product into high memory, disks, and so forth, leads you to see that those products, which had really been conceived for a different purpose, were starting to be

used heavily in business, where they really had a lot of limitations.

PL Forty-column screens, that sort of thing?

Peddle Well, just the whole concept. They were aimed at a different market. If you look at the VIC-20, it is really the original PET repackaged at a lower price—that kind of thing.

We believed that a third generation of microcomputer was coming that would be compiler-oriented, would have multiple high-capacity disks, lots of compute power, synchronous communications, and high-resolution screens, a product that would be designed to be used as a desktop machine in an office network. It was going to be used professionally. It was an office product as opposed to these other products.

We felt that several developments—the new architectures of new micros, the dropping prices of 64K-bit RAM [random-access read/write memory] chips, what had happened in floppy-disk capacities, what was going to happen in hard disks, what was going to happen in networks—basically gave us the opportunity to design a new generation of product. So the goal for the Victor 9000/Sirius 1 was to have a true, very competitive, desktop, entry-level product that could be marketed by the office-products dealers but would also be sold by a sophisticated computer dealer as really a replacement for the higher-end applications of the personal computers and the lower-end applications of the pseudominis and minis. That's a very crisp market



Chuck Peddle

definition, a very crisp generation definition.

PL How long did the design of the computer take?

Peddle We fundamentally formed the design team in late December of '80 and started operations in January '81. We showed the first prototype product in April of '81.

PL How many people were on the design team?

Peddle Basically about eight people. It grew after that as we built things.

PL What processors did you consider and why did you choose the 8088?

Peddle We looked at the dual 6502, which was fine except there was no programming base—a small base in Europe, but none in the United States. We looked at 6502 and Z80 combinations, which would have given us an Apple look-alike and a CP/M look-alike. But we concluded that the memory-management prob-

lem, while it was solvable, would lead to the sort of machine from which a software base would not naturally evolve. If we were a world leader, like DEC or some firm like that which has its own proprietary software, it might be worthwhile. But these two approaches wouldn't satisfy our software needs.

We then looked at the Motorola 68000. You know, even though I'd been with the Motorola family from almost the beginning, the conclusions were that product was never going to be as cost-effective as the Intel 8086 family was going to be, the

support languages were not there at the time, and the 8088 was a very interesting alternative to the 8-bit micros, which we felt we had to compete against from a cost standpoint, but the 8088 also had the ability to migrate upward into 16-bit software.

PL Is there an 80286 [Intel's new very high performance version of the 8086] in your future?

Peddle There's anything that Intel does in our future.

PL The standard memory in the Victor 9000 is 128K bytes. Is that true of the Sirius 1 too?

Peddle Yes, the Sirius and the Victor both. The business strategy for that is very simple. Victor was literally with us from the time we started Sirius Systems Technology. The company was a partnership. We talked to Victor within a week after we formed the company—

PL It's more than the traditional OEM relationship?

Peddle That's right. Victor and Sirius were partners right at the beginning. We talked about the concept. Our business strategy was to compete for Victor's business with Japanese companies, giving Victor the same kind of pricing they would have gotten out of the Japanese. Letting them build a volume base for us in the United States, while we, because of our special knowledge of the international market, would concentrate outside the United States market. We were trading volume for specialized market, in this case, to get higher profit margins. The decisions that went into the computer design were always based on this premise. Therefore, the boards in the Victor 9000 and the Sirius 1 are the same, the power supplies are the same. It's basically the industrial design that's different.

PL The 128K bytes of standard memory was a huge amount a year

ago, and it's still a lot, for standard equipment. But now that memory's gotten much cheaper, are you thinking of adding more memory in order to take advantage of the new operating system improvements that I keep hearing about?

The Victor 9000 has the smallest footprint of any word processor.

Peddle Remember two things. First of all, we offer the most memory expansion in the market.

PL Something like three quarters of a megabyte?

Peddle It's more than that, it's really over 900 kilobytes. We have announced a 256K version of the machine that we're currently supply-

ing with a 128K expansion. We're shipping all of that expansion product, and so the answer is that we see an evolution for the development machines almost exclusively to 256K, and some level of application machines to 256K. You've got to watch it. The market's such that when you have to compete against the Z80 and 6502 machines, you've got to be careful not to have too much in your baseline machine when you have to go in—at least on a price-quote basis—against these machines with a lot less capability, and we're able to come close in price.

PL After you decided you wanted to have something in the range of 1.2 megabytes of floppy storage, why did you choose 5¼-inch drives instead of 8-inch?

Peddle Cost, packaging. The Victor 9000 has the smallest footprint of any word processor in the marketplace, much less any personal computer.

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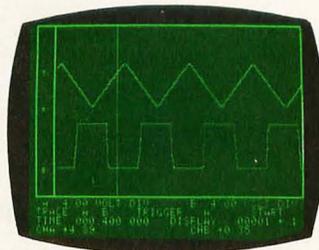
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PL And that couldn't be done with 8-inch thin-line drives?

Peddle No. The form factor on that design was very, very compact. It was designed to sit on the side port of a secretary's desk. Remember our primary market is Europe, and Victor wants to be a factor in that market too, and therefore we had to meet the latest European ergonomic standards. Packaging 5¼-inch drives led much more easily to that. Typically 5¼-inch drives are cheaper by far. We believed that we could pack the 5¼, and we could get enough capacity into that size on the basis of techniques that we'd used previously. And we were able to do so without any sacrifice of system reliability. In fact, we have a more reliable system. We've done some tests on alignment. We're less sensitive to alignment problems than normal 48-tpi (tracks per inch) drives.

PL I had the machine for several months, longer than I intended, for several reasons. I tried to do things with huge files to cause problems, and I haven't been able to generate a single disk error. So I'm convinced.

Peddle Yes, if you look at the way we've done it, the systems concept is much more inherently reliable. We've got a very tuned phase-locked loop, which we're operating very effectively at a single frequency, but we have none of the normal droop and signal-to-noise problems that most disk drives have because we're really recording at constant density all the way across the disk.

PL The constant linear speed is a factor too?

Peddle Right. The combination of the phase-locked loop and the constant linear speed is unique.

PL In order to include these two characteristics, did you have to design your own disk-controller board?

Peddle Perhaps, but quite frankly, the system is optimized for cost as well as performance. We get higher-capacity disks and higher-resolution

screens. We consider our forte to be systems design. That's what we are—systems designers, systems architects, as opposed to just logic people. We have a mixture in our company of big computer people and microcomputer people, specifically for the purpose of doing a better job of systems architecture from the top down.

PL Why did you use the 6522 parallel I/O chips for the disk-controller board and other input/output? Specific design virtues?

Peddle Yes, basically. We used them for some things we do with printers and particularly for our parallel ports. Look at the way we did our IEEE or printer port. We needed to have the ability for our I/O devices to be glitchless when we change states and directions. Intel parts aren't. Motorola parts and MOS Technology parts are, because we designed

them that way. By the way, I used Intel parts to begin with. Had to redesign.

PL Why did you choose Group Code Recording [a technique of compressing data by squeezing out zeros] as a method for increasing disk-storage capacity? Were there other options?

Peddle No. We proved to ourselves long ago that Group Code, with the higher bit densities and the kind of recording scheme we had, gave a much more reliable recording. It's a question of reliability as much as it is higher capacity.

PL Is the encoding itself done in the BIOS [basic input/output system]?

Peddle No, it's done in the disk-controller chip that does the speed control, and yeah, there's a small amount in the programming. The system is really a combination of

micro- and multiprocessing, if you will. Some pieces of the stuff are done in the chip itself. Some of it's done in a ROM [read-only memory] that's outboard—it's currently being implemented into a gate array—and some of it's done in the outboard micro that's in the controller. So it's—I don't like to overuse the term "systems design," but in fact that's what it is. It really is a totally integrated design. You partition pieces of it but the focus is constantly architecture.

PL The high-resolution monitor is one of the computer's most striking features. A lot of computers now have separate RAM for the screen. Your computer has some screen RAM, but it also gives the monitor access to main memory. Why did you choose that approach?

Peddle First, cost. Second, programming ease—the ability to move

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memory around for some of the high-resolution kinds of things we do. Third, it's a trade-off. You can use character graphics part of the time and give yourself back about 40K of memory. If you want to go into high-resolution mode, you give up that memory. So it's an architectural decision. The only memory we have out-board is there because for timing purposes we needed another memory. We're already really doing a 32-bit fetch for the screen right now. We needed some parallel memory in order to be able to do that.

PL Why the Hitachi 46505 CRT-controller chip?

Peddle It's a third-generation computer. Therefore we were looking at a state-of-the-art product that was just coming out. Look at what we did with the CODEC [coder-decoder for digitized voice]. Look at what we did with the communications chips. We

were looking for the thing that was the best product at that point in time, even though the price was high, because we felt that we didn't want to redesign later. So we went with the best ICs we could get, under the assumption that the price would drop.

PL For the RS-232C serial ports, you chose the 7201 programmable communications chip. I know one programmer who's been singing its praises as something to use in writing communications software. But why that particular chip?

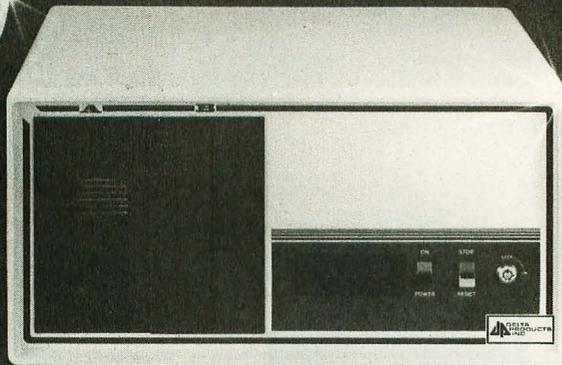
Peddle We felt that you needed a channel of synchronous communications. The 7201 gives us two channels, totally under program control.

I want to contrast what we consider different in the third generation from the second generation. Second-generation computers were basically ROM-based machines, right? They

were designed to power up, run, and go. They were designed to be used by fairly trivial programmers to write simple programs. What we discovered was that all those architectures kept getting in the way of the more sophisticated programmers. On this machine, we felt that almost all programs would be written by sophisticated applications programmers, and you would have a higher level of operating languages and utilities. And, therefore, we wanted to make the machine absolutely as soft as we could, so that programmers could just get in and do anything. The keyboard is an example of that. The whole concept of the keyboard is to allow universal configurability by the programmer so that you can have a machine that is so personalized that the user buying the product believes he is buying a unique product. What he's really buying is a general-purpose piece of hardware, which we

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built, and a very sophisticated, specialized piece of software written by a creative programmer who's solving that particular problem. But if those are married and properly packaged and presented to a user, he'll believe this machine is tailored for him, whereas you couldn't do that with products from the previous generation.

So the whole idea was to put enough hardware in the machine—the communications chip, pro-

grammable data rates, and so on—to stay out of the programmer's way.

PL I guess there's no reason why the keyboard couldn't be switched to a Dvorak format?

Peddle Absolutely. Whatever you want. Have fun.

PL Is anyone doing it yet?

Peddle No, we haven't seen anybody do it, but we're already supporting 31 different keyboard styles.

We intend to support as many keyboards as people want to create.

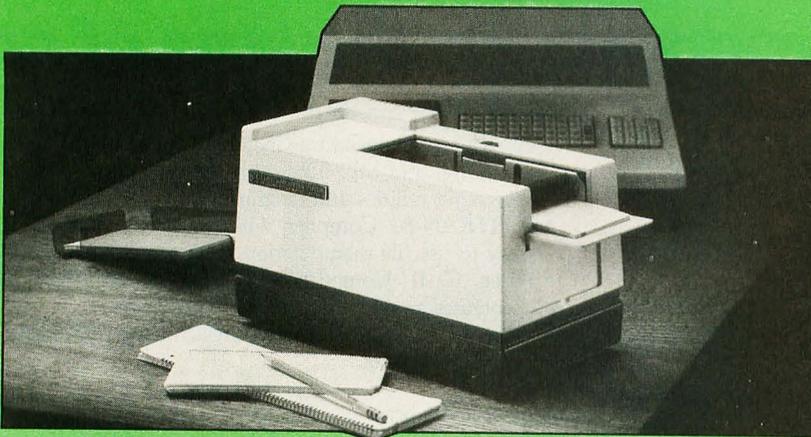
PL The 8048 microprocessor seems to be a popular choice for keyboards, but it's really a general-purpose microprocessor isn't it? What suits it especially to scanning and so on?

Peddle It's available from Intel, and it's quite reasonably priced. You know, there are a couple of others that were probably equally doable, but I think the answer is really that it's an Intel product.

PL What applications did you have in mind for the CODEC voice capability?

Peddle It's our belief that machines in the business environment are going to have to become increasingly user-friendly. That's the reason for the high-resolution screen. If we could do it, voice input would be in the product right now. It will be if it ever becomes available. You could buy a Datsun 280 ZX that has a pretty voice to tell you the door is open. You're going to be able to buy a refrigerator that will talk to you before long. We believe voice is the competition that the Japanese have chosen for the next generation of consumer products. We feel that the use of the voice to personalize training, to interrupt for electronic mail, is something that will be required by customers in the near future. High-resolution graphics on the Apple II showed us something about what this marketplace is all about. On the PET, we put in character graphics because it was cheap and it was available. We won design awards with the PET character graphics because the average programmer could jump all over them and was made happy quickly. In the long run, the Apple graphics won because more creative programmers could do more with that product, to the point that we felt that a next-generation product couldn't *not* have high-resolution graphics. We think voice fits the same category, that by making it available, we will have a whole generation of programmers start to use it.

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You know, we showed the concept of what I consider to be the first personal computer to the financial community. The first announcement and demonstration was in New York in early '77. People said, "Why do people buy these things?" Kind of a funny question. I answered them with Edison's concept about the electrical industry: "What use is a baby?" Okay? And in fact, I think my implied prophecy was correct. Fundamentally, we're at that stage with voice. People will find a use for it.

PL What part of the design of this computer gave you the most satisfaction?

Peddle [Laughs] Making the company happen, for me personally, because I got a chance to do only a little bit of the design work this time. I did less on this computer than any of the things I've done over the past few years. I think the fact that we met all our goals, achieved all the things that we set out to do. This is the most sophisticated product that has been done in this kind of a marketplace. We had to bring together several talents who had not worked together before. Making all those talents come together—the guys that understood IBM-compatible communications along with the guy that designed the VIC-20. There's a lot of space between those people. Bringing them all together was satisfying. So I guess the answer to your question about the most satisfying part of the design of the computer was "none of the above."

PL What do you think general-purpose business microcomputers will be like two years from now?

Peddle Network. Lots of memory. Very, very hard-disk-oriented. Sold through a different channel from that which the current marketplace is mostly being sold through.

PL What sort of channel do you see?

Peddle I think that you're going to see more use of the mixture of direct and pseudodirect sales. I think you're



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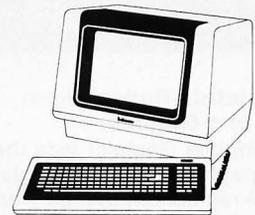
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going to see a lot of follow-on selling. More service-oriented kind of selling. I think you'll see computer retailers change into people who are more market-focused. I think you'll see a lot more vertical markets. Some of the people that others think of as more traditional retailers are going to focus more and more on selling this product in a packaged kind of way. I think you'll see dramatic changes in point-of-sale presentation. I think videodisc will be very important in both applications and point of sale.

PL What do you think home computers will be like two years from now? How many of them do you think will be around?

Peddle Luckily, millions. I think the market for computers split two years ago. I'm going to define two major segments, and there's a smaller middle segment. One major market segment is the throwaway computer, the concept that the Sinclair [ZX81] epitomizes—the kind of computer that nobody should buy but everybody does. Truly disposable. You get the VIC-20, the TRS-80 Color Computer kind of thing, which has meaning and usefulness in terms of computer literacy, games, some form of that kind of activity. And then you get the more serious, third-generation computers that are really aimed at solving problems. They're big, they've got enough disk capacity, and hooked together they really attack. I think what's happened is the guys who started this market find themselves in the middle. They're not powerful enough to compete with the higher-end guys, and they're too expensive to compete with the low-end guys. Other than the education market, which I consider to be a very specialized market and which I expect Atari to dominate—in this country at least, because they've got some real strong leads in that area—I think you're going to see a real dropping out of what I call the middle-range computer buyers. You're going to see a lot of stuff under five hundred dollars, and a lot of stuff in the three-to five-thousand-dollar price range,

and relatively little in between.

PL Looking at the other end of the microcomputer market, how much do you expect the superchips, like the Intel 80286 and the National Semiconductor 16032, to cut into the mini-computer market?

Peddle I'm going to not answer the question but give you an answer as to what I think is happening to the mini-computer market. I've been a distributed-intelligence fan and dedicated to making that marketplace happen since 1967, working for General Electric and for several companies that were really all distributed. I think I made a contribution to that marketplace. I think the minicomputer represented, at the beginning, a first step in distributed processing. I think the microcomputer companies are, in fact, representing the next step in that. And I think networked microcomputers are, in fact, a new product. Now, the question is, what benefit do I get out of a 32-bit machine? If I get a bigger language, better memory management, those kinds of things, code that I need to move from some other place, sure, I'll have that. But in fact, if you look at the number of new programmers and the number of people who have the opportunity to really crank out user-friendly and very meaningful programs, I think that's the most exciting thing about the microcomputer marketplace. It's not a given that the kind of programming that has to be done to make computers usable by people has to have that 32-bit power. Price drives people. Software availability drives people. But I think that the mainframe step-up in function is less important than what we do with databases, for instance. Does one of those micros make the generation of very powerful back-end database processing possible? Then it's very exciting.

PL So you think multi-user systems are going to fade away in favor of networking?

Peddle I've believed that for a long time.

PL Will multitasking, then, be an essential feature in single-user systems?

Peddle I think so. Just to run the networks and to do local spooling and all of the things that you want a computer to do. A computer should do what you want it to do. If it's capable of doing several things at one time and not slowing me up, it ought to do those things.

PL Without regard to the limits of current technology, what features would your own dream-machine have?

Peddle Voice in. Video messaging. A total product that allows me to work anywhere in the world and communicate with others anywhere in the world and with databases anywhere in the world.

PL Portable?

Peddle Both. One in my office and one in my briefcase and maybe one in every hotel room. I really want to be able to talk to them. I want to have all kinds of my own private storage. I want to have access to a worldwide network of storage.

PL What competitors do you fear more, the small start-up companies with venture capital or the big computer companies? Is the time past for the small company?

Peddle I felt that we were the last venture-capital start-up company—we're not venture capital, because we're funded by Kidde, but that was alternate venture capital. Fortune seems to be trying to prove me wrong. Grid does also. Grid has a specialized product. If we're not the last, Fortune is, in my opinion. The minicomputer company that I fear the most is DEC. The big computer company I fear the most is IBM. The third company I fear the most is whichever Japan decides to let be the winner.

PL You think they'll decide that?

Peddle I think if they don't, they won't beat either of the other two guys. ■