Ten

years ago

this man

and this

computer

started a

revolution.

The Apple II

would change

his life,

and yours,

forever.

Steve Wozniak started a revolution. In 1975, he designed the Apple I, the computer that led to the founding of Apple Computer, Inc., in January 1977. A few months later came the release of his next design, the Apple II, and thus began a family of tremendously successful personal computers that hundreds of computer companies, from DEC to IBM, eventually imitated.

Since 1977, Woz, now 36, has hardly remained a steady fixture at Apple. He's used his personal wealth to engage in other projects, such as two highly publicized US Festivals, and he started a new company in 1985 called CL9 (Cloud 9) that makes remote-control devices. Still, Woz has remained close to Apple. He has suffered through the times when the Apple II took a back seat to newer ideas, and he's proud to be involved in the renaissance the II currently enjoys in its latest incarnation, the IIGS.

Senior Editor Lisa Raleigh recently visited Woz at his CL9 headquarters in Los Gatos, California, where he showed up with his four-year-old son, Jesse, in tow. Woz set up Jesse with a laser-disk version of the movie WarGames and turned to discussing the last ten years.

WOZ
ON THE LAST TEN YEARS

A+: With Apple's ten-year anniversary coming up, do you have any plans for a celebration?

Woz: No. To celebrate, I'll get my ten-year pin. I've made sure that, even when I wasn't directly with the company, I was being paid the minimal salary that kept me on the computer as an official employee. So, when the computer cranks out how many people get their ten-year pins, I'll be on it. I never till this day have missed an Apple paycheck.

A+: At the IIGS introduction, there was a tape about the development and interviews with the development team. You appeared to be a part of that.

Woz: Yes, that was back a couple of years ago. That was when I was there. I had been a very key part of the Apple IIx development, but it was reformulated as the IIGS. I had been like the key participant in the early definitions of it. A lot of the ideas that we should be doing such a product as an enhanced II and the artificial limits [imposed] because of another product in the company were wrong—and even ideas as to how the computer should be implemented, how the memory addressability and banking should be implemented. I took very strong stands against extending the IIe architecture because it was so bad. I advocated just totally doing a new, fresh one.

Virtually everything I supported came out in it, but what really made the product go was when Rod Moore sat down and worked out a good, usable, hi-res-graphics scheme. In the IIe, we added a thing called double-hi-res graphics, and it was unusable by software people. It was a mess. It was a nightmare. It was very limiting to the machine. The scheme that the IIGS group came up with really took off because of their strength in doing custom chips.
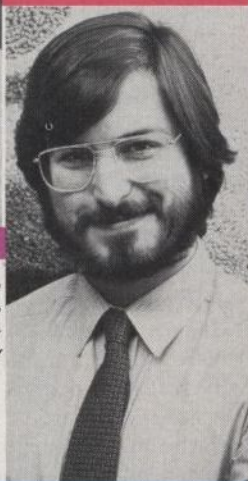
A+: What is it that you did well that allowed the Apple II to start the revolution that it did?

Woz: My role in the Apple II was the engineer or the designer. You tend to always want to make your own category be the most important, so it might sound a little biased, but I
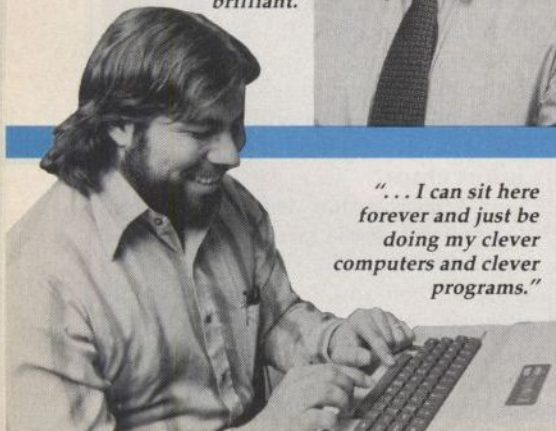
APPLE

COMPUTER CO.

would say that technically its features have not really been given the credit that they deserve. It had very few chips, which made it manufacturable. I could name about ten things that you could say were so important that that's what made the computer revolution happen. They had never been done before. It's not like this was an improved version. They had never been done ever on a low-cost computer.

A+: Can you name them?

Woz: Sure. Color—never been done as a standard feature on a low-cost computer. Graphics—never been done before. High-resolution graphics. Including BASIC in ROM with the machine. 48K of RAM; that scale of memory had never been offered as a standard feature. Sound. Paddles. Game commands built into BASIC. It had never been done.

The Apple II took a really major step in its time frame that put it way ahead of everything else: it said that your output device was your home TV because it was free. The ones from Commodore and Radio Shack, plus all the hobby computers—none of them said your TV was your output device. It was either a teletypewriter or you bought their monitor.

A+: How is it that you made all these bold decisions?

Woz: There was no intent to have it be a product. It was just an intent to do the best computer I could to show off at my club. I was very lucky also. When you sit down to design a product, maybe you're very good at a certain type of optimization, but when ten things all come together at once in a very short time frame—this is all like in half a year to a year of Apple II development—it is just magic.

But, of course, the company was very successful. There were a lot of people building good computers back then—and I will say now that there was nothing close to the Apple II. Still, we put together a big company. Mike Markkula knew what to do. He came in as an equal partner and loaned us a quarter of a million dollars so that we could build a thousand Apple IIs. And he started setting up a marketing plan—where we saw our products at the start and where we would eventually sell them. It turned out we thought we were going to sell

them to the home, to do your checkbooks, and we really wound up selling them a lot into business. That was really unforeseen in the early days. We didn't even know we would ever have a floppy-disk drive.

We had Mike Scott handling operations. Steve Jobs had twice the energy of anyone else and was very brilliant, so any task that needed doing in any category got done because Steve was there. So basically everything to make the customer happy in the end, which included building it, we did successfully.

A+: Is there anything you can pick as a highlight of the last ten years?

Woz: The Apple II floppy-disk controller—no question about it—as far as how well the project turned out from technical viewpoints. It's a rare story. I didn't know one thing about disk drives or operating systems. I'd never studied them, never read about them in books. Turns out the only reason our controller turned out so well was because I didn't know how to do it by the established means. It was a very fast project. It was like a week for the hardware design. Up, running, demonstrated.

A+: So that was a highlight because of your satisfaction in doing it fast and doing it right?
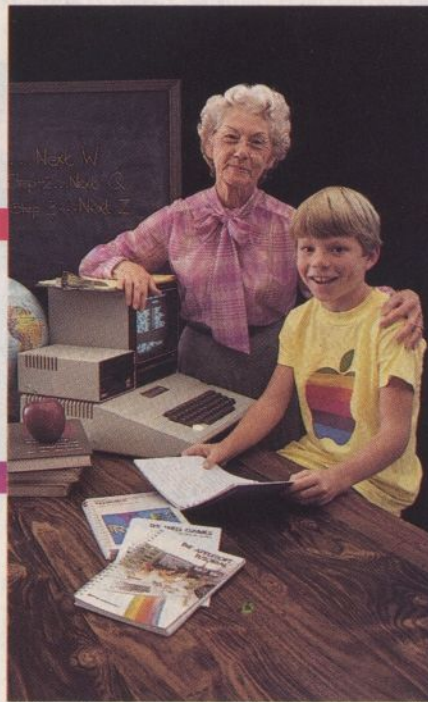
Woz: And a clever idea. A clever approach only because I would not have taken it if I had ever studied disk controllers or operating systems. All I was trying to do was an implementation that I knew could write some information out magnetically and read it back in and figure out what it was. Randy Wigginton and I went in every day over Christmas vacation of 1978. He was doing some software, and I was testing out the hardware and doing other parts of the software. In one week, we got a demo up that we could type RUN CHECKBOOK on and it would run. That's an amazing amount of hardware plus software to ever get done in that short a time frame. It totally spelled a major future for the company because Mike Markkula at that point had identified a floppy disk as our most important needed item.

A+: If Apple hadn't happened, what do you think you'd be doing now?

Woz: Oh, I'd be an engineer working on computer design at Hewlett-Pack-
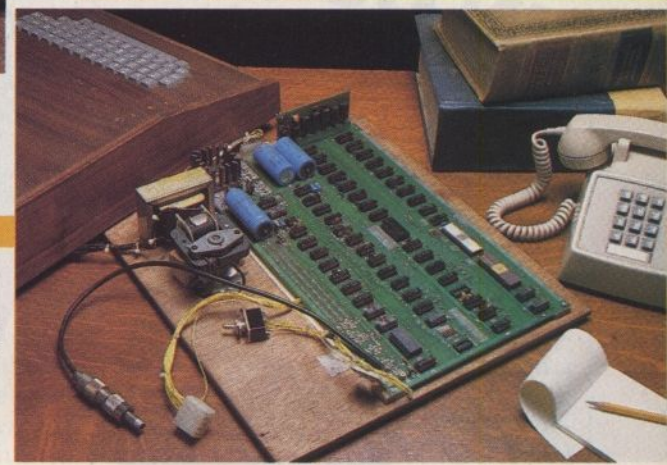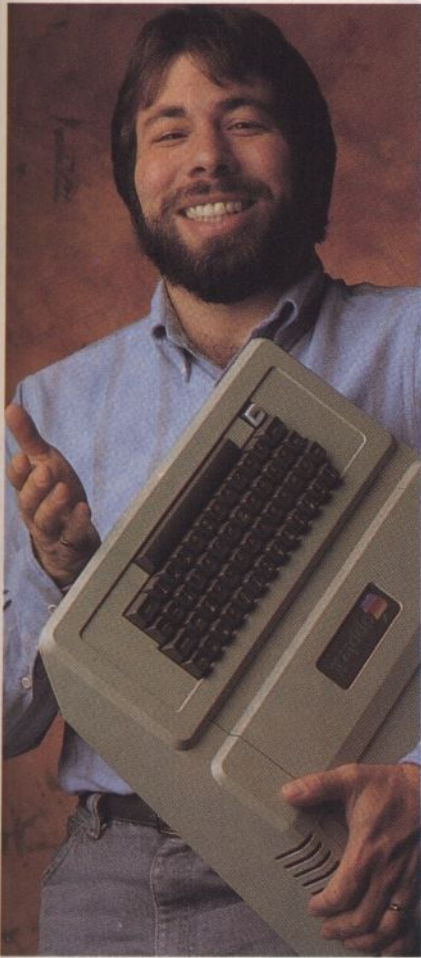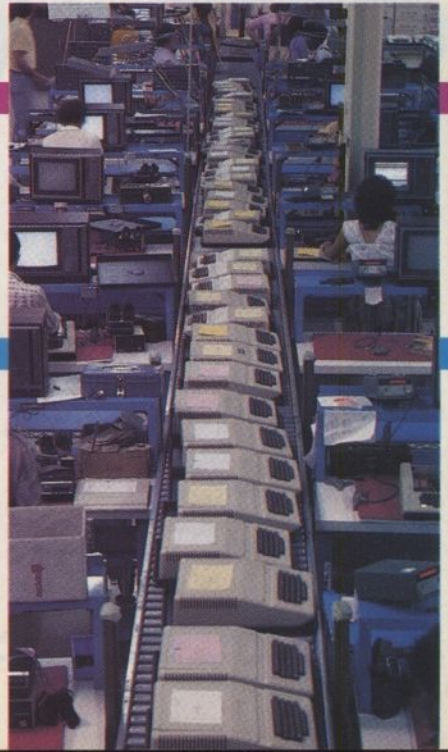
Steve Wozniak (left) designed the Apple I (photos top, right, and below right), the computer that led to the incorporation of Apple Computer, Inc. ten years ago.

ard probably. I'd probably be an engineer, if not a manager.

A+: Is there anything that you would do differently if you were starting over again and you knew what you know now?

Woz: Yeah, absolutely. If I'd known where the computer was going to be used, for what sort of applications, I would have added a few chips to make programming some of the hardware a little easier.

Personality-wise, I might have tried to take a stronger stand in the company, but I think not. I think I did all the right things, because you need a good engineer getting the products done when you're very small. And my attitude was: be quiet, do what I can do, because I can sit here forever and just be doing my clever computers and clever programs. And I'm not going to get in fights and argue with people and think that I have to have a higher position and run things. I thought I was doing the right thing, and I was. I would absolutely do that again.   +

Apple's ads then (above), as now, stressed the important role computers could play in education.

Apple IIs roll off of the assembly line.

APPLE:
THE FIRST TEN YEARS

In its first decade, Apple introduced seven versions of the Apple II, five versions of the Macintosh, three versions of the Lisa, and two versions of the Apple III.

With 18 computer models and several dozen major software packages and peripherals to its credit, Apple turns ten years old this year.

Besides the one-and-only Apple I, Apple has introduced seven versions of the Apple II, five versions of the Macintosh, three versions of the Lisa, and two versions of the Apple III. Apple DOS has been rethought and rewritten at least six times; the Macintosh Finder, not nearly so old, has gone through even more (although subtler) changes. Some peripherals—most notably the disk drives and monitors—have changed appearance almost as often as Zsa Zsa Gabor has changed husbands. Manuals have been written, rewritten, rerewritten, and written over again; some have even been reedited and published by other companies. Yet in all that time, Applesoft BASIC still remains the same. What gives?

The best answer, it seems, is that that's the way the Apple bounces. Apple has a notorious history of appearing to be at the forefront technologically but a bit haphazard about refining its products and best serving its users. If you want to get a copy of the latest Macintosh Finder, for instance, don't wait for Apple to notify you that it exists. Instead, run, don't walk, to your nearest dealer or users' group with a blank disk, which will be happily filled with this month's version.

All this frenetic updating activity and releasing of not-quite-finished products dates right back to day 1 and the Apple I.

The Beginnings

Steve Wozniak originally designed the Apple I to be a video teletypewriter centered around the 6800 processor chip. In fact, if you ever get a chance to look at the silk-screened legend on the board, you'll see the evidence of its origins—an area in the lower left corner reserved for the 6800 and its support chips. Woz was able to get 6502 CPUs more cheaply, however, and apparently was more fascinated by their design, so the final version sports this processor instead.

For the evil-sounding sum of $666 (and 66 cents), you could purchase an Apple I. But what you got was a mishmash: a PC board with CPU, video circuitry, and memory, plus a keyboard—but no power supply, no case, no cassette interface, and no software other than the ROM. The manual was a mimeographed piece, the only reasonably good thing about it being the drawing on the cover, which depicted a likeness of Sir Isaac Newton sitting under an apple tree. Some people refer to this drawing as the original Apple logo.

The machine worked, though, and it worked as well as did anything else at the time. If you wandered on down to the Homebrew Computer Club meetings at the Stanford Linear Accelerator, you could even pick up hand-drawn schematics and get software and help from Woz himself. If you were in Bloomington, Indiana, at the time, as I was, you didn't know any of this, of course, and had to get along as best you could.

The Apple I made a workable terminal for other systems I was using at the time, but I remember that several of us at the computer store where I worked spent the better part of a week trying to increase memory from the 4K chips Apple used to the 16K chips that were becoming the state of the art.

Something about that initial offering of Apples has managed to persevere to this day. Apple is not the "master-planned" behemoth IBM is. Apple does not do anything by the numbers (other than product names, that is).

Which, I suppose, is as good a place as any to introduce the Apple II into our history. Even Apple's compilation of the company's history isn't clear on when the first II was really shipped or when it became a

Apple's PROGENY

18 MODELS IN 10 YEARS

In the past ten years, Apple has introduced 18 versions of its computers. Here's a listing of the systems that populate the many Apple computer families. The Mac XL is counted twice, both as a Mac and a Lisa, since it really is a split-personality machine.

APPLE I
The original Apple, available in kit form only
APPLE II
The first personal computer with built-in BASIC and color video
APPLE II PLUS
Applesoft in ROM

APPLE IIe
Enhanced memory and video
APPLE IIc
Portable case, built-in slots, 65C02 processor
APPLE IIe ENHANCED*
65C02 processor
APPLE IIGS
16-bit processor; enhanced graphics, sound, and memory

APPLE IIc ENHANCED*
3.5-inch drives, enhanced memory
APPLE III
Most sophisticated 8-bit personal computer ever built
APPLE III PLUS
Enhanced memory and video

LISA
First personal computer with 32-bit processor and graphic user interface
LISA 2
3.5-inch drives, file-compatible with Macintosh
MACINTOSH XL
Macintosh Finder on top of Lisa operating system
MACINTOSH *First low-cost 32-bit computer*

MACINTOSH 512K *Increased memory*
MACINTOSH XL
Mac Finder on top of Lisa operating system
MACINTOSH 512K ENHANCED
New ROMs, 800K drives
MACINTOSH PLUS
One megabyte of memory, 800K drives, SCSI interface

*Apple's formal name for these products does not include the word enhanced.

II Plus. The early Apple II was the charmer of its day. Woz basically took the Apple I design, waved a magic wand over it, and came up with some circuit wizardry. He designed the circuitry that generates the color display, for instance, in a way that no other engineer would have. Woz simply noted that phase-shifting certain signals had the *effect* of changing colors on a color TV.

Even today, the results seem remarkable. When you consider that the IBM Color Graphics Adapter has more than four dozen chips on it to perform its function, the half dozen chips that comprise the Apple II's color circuitry might seem inadequate, but they aren't. At 256 × 192 pixels, the original Apple II generates six colors, while at 320 × 200, the IBM Color Graphics Card generates four. Newer Apples, of course, expand on this video concept and generate many more colors at higher resolutions.

Apple refined the cassette port of the Apple I and built it into the II. It also expanded the computer's memory capacity and added on an eight-slot bus structure and a simple analog-to-digital port to accommodate game paddles. The references to the 6800 disappeared. The BASIC that had been designed for the Apple I went through a metamorphosis, and many of the routines went into Integer BASIC for the II.

But the real breakthroughs—the hallmarks that defined Apple's market for some time to come—were the plastic case, the seven-pound weight, and the built-in power supply. This was 1977, after all, and the nearest competitor to what the two Steves had come up with was the Sol 20, which also had its origins as a video teletypewriter but weighed in at almost 30 pounds, was made of rugged sheet metal (adorned with oak side panels, in the style of some stereo equipment of the time), and was several inches bigger in almost every dimension.

Women actually *liked* the diminutive Apple II. I can't begin to count how many times a man dragged his wife into our little midwestern computer store and was drawn to all the wires and components and lights in the IMSAIs and Altairs we carried.

Meanwhile, the woman would keep asking, "What about this one over here?" pointing to the one thing in our store that looked reasonably nontechnical: the Apple II. The smart men bought Apple IIs; the not-so-smart men argued with their wives about whether or not buying an IMSAI in kit form was a wise investment of time and money.

The Apple logo helped convey a message of simplicity and comprehensibility. The Apple name was friendly. After a few months, even the Apple manuals looked approachable (although we could never anticipate which manuals were going to be included in a box—the manuals seemed to keep changing, and every shipment brought a new set of documentation). The hardcore engineering types bought the other stuff in our store; the merely curious about what computers could do bought Apples.

Since the Apple II, like most of the computers of the late 70s, was an "open" system, some engineers did buy Apples—and they did with them what engineers like to do, which is tinker. Meanwhile, Woz and his newly hired cohorts, such as Chris Espinosa, Randy Wigginton, and Rod Holt were tinkering, too.

In rapid succession, out came the Sup'R'Mod (an RF modulator that connected the Apple's video to a television set and that probably prompted the FCC's original interest in setting RF standards for computers), Applesoft BASIC (on cassette), a joystick (to replace the game paddles you normally received, with which it was virtually impossible to play the supplied Star Wars game), and any number of memory-expansion options (at that time, you could simply plug in more memory, if you knew what chips to use and how to make memory-header blocks). A parallel card and a serial card began to make connections with various input and output devices.

Within 18 months, the II Plus appeared, with Applesoft in ROM and, originally, no simple way to run Integer BASIC. Then came the Language card and Apple Disk II. UCSD Pascal was not too far behind. Music boards, 80-column video boards, and even other CPUs—such as Z80s and

What's in a CODE NAME?

Code names are a byproduct of war. And because it's warfare out there in the computer industry, computer companies have adopted code-name campaigns to baffle the enemy.

GUMBY

RAMBO

GOLDEN GATE

PHOENIX

BROOKLYN

CORTLAND

Unfortunately, these code names sometimes end up confusing even their originators. At the press conference to announce the Apple IIGS, for example, different Apple engineers used different code names to refer to the product.

During its three years of development, the IIGS had at least seven code names: IIx, Brooklyn, Golden Gate, Phoenix, Rambo, Gumby, and Cortland (see "The Making of the Apple IIGS" in the November 1986 issue for more details). According to Wayne Rosing, who was director of engineering for the Apple II group, the company became obsessed with code names for the IIGS in the spring of 1985. "It seemed like we had a code name a week," says Rosing.

In this case, none of the code names stuck. Another Apple product—the Macintosh—did go to market with its code name intact, though. According to Jef Raskin, manager of advanced systems at Apple during the product's development, the development team suggested names of a variety of different apples. Raskin had a preference for McIntoshes. He had to change the spelling to Macintosh, though, to avoid a trademark conflict with McIntosh amplifiers.

Raskin remembers that then-Apple-Chairman Steve Jobs wanted to call the Macintosh Bicycle and went so far as to have buttons and posters made up. Nobody took Jobs up on the name, however.

Another code name that stuck was Lisa, which designated the Mac's predecessor. Before it fell victim to market forces, this computer fell victim to the acronym-concoction game as an attempt to mask the real origin of the name. Common wisdom now has it that the computer was named after Steve Jobs' daughter, and, according to Rosing, this technique followed a procedure established when the ill-fated Apple III was earlier code-named Sara, also after the daughter of someone at Apple.

Apple "reverse-engineered" the term *locally integrated software architecture* from the alleged acronym LISA. One reaction to this mouthful was that LISA really stood for "let's invent some acronym." This assessment has a certain ring of truth: A common practice among computer companies is to come up with a product name and then fabricate a sobriquet whose first letters spell out the product name.

Rosing says that Apple came close to naming the Lisa Applause. One day, though, an engineer threw a package of Applause prophylactics onto a table, and that was the end of that name. Another factor that determined the Lisa's name, Rosing notes, was that the industrial engineers had tooled just enough space for a four-letter name onto the computer.

Peter Quinn, who was engineering manager for both the IIe and the IIc, recalls that the IIe started its code-name life as LCA, for Low-Cost Apple. At one point it was designated the Super II, but the team scrapped that because they didn't want people to guess what they were working on.

The Apple IIc spawned a wealth of code names, recollects Rob Gemmell, who was a senior product designer for Apple. "We changed the name every month or so to keep industry-watchers confused." Gemmell notes that the IIc group had people within the company confused as well.

Gemmell remembers some of the code names for the IIc: VLC, for Very Low Cost; Yoda; and ET. "We bandied around IIB [for Book]" because Jobs wanted it to look like a book, says Gemmell, and early sketches showed a rectangular machine.

For a while, Gemmell notes, it took on the names of the sons and daughters of people at Apple: Chels, short for Chelsea, daughter of the marketing director; Jason; and Lolly, after the daughter of Peter Quinn.

When it came time to code-name the IIc, "We went nuts." In addition to all the names noted above, the IIc was at various times called Sherry, Zelda, and Teddy. The latter name came from the test group. "It stood for Testing Every Day, or something like that," Quinn recalls. Quinn also remembers that an Apple executive once decided to try using obscene code names to discourage the media from using them. One such name was LF, for Little F-----. An extension of that name was ELF, which meant Everybody's LF.

And so, over the last ten years, Apple has waged its code-name campaigns.
—*John A. Barry*

6809s on add-on cards—that simply plugged into the expansion bus began to appear. One third-party developer even offered IBM-compatible eight-inch disk drives.

Other changes happened faster at a less visible level. The II Plus had a Revision 6 motherboard, then Rev. 7 (which seems to have two varieties) and Rev. 8. The ever-changing motherboards gave rise to a new game: Can You Guess What Apple Is Up To? By examining these circuit boards, you could see circuitry that hinted at future functions. Tracing the schematics of older machines and comparing them to the layout of the new motherboards revealed lowercase capability long before Apple actually made it available to its customers.

Slight changes in the video ROM appeared, the benefits of which were open to rampant speculation. An enhanced keyboard caused all of us who had installed lowercase converters in our machines to weep in misery. Many of us had rushed to buy new Apples (and sell our old ones) when new systems came out, and we often found that add-on products didn't always transfer to the next machine. A lowercase converter, for instance, wouldn't work with a later Apple II Plus unless you discovered the special way to connect it.

The Apple IIe offered further improvements to the final version of the II Plus. The chip count on its motherboard was lower, because it combined the functions of many chips into one. The IIc went one step further by eliminating the slots and putting the most typical add-on enhancements onto the motherboard. The IIGS further reduces the chip count by combining still more functions, but it opens up whole new areas to explore by adding a new processor, faster memory access, some sleight-of-hand gimmicks to increase the video resolution, and a new way to create sounds.

So I return to the question, why is Applesoft BASIC still the same old Applesoft BASIC? After all, everything else about the II seems to have changed in the last eight years.

The answer is typical Apple: BASIC retains compatibility with the past while allowing Apple to explore new frontiers of technology. At some point in a product's history, the company freezes its design and reduces it into a building-block component. Add new components and you have a new machine—and, oh by the way, it's sort of compatible with what we used to sell.

Consider the Apple II Disk Controller. First there was the 13-sector version and then the 16-sector version (a few of us went on to piggyback chips on our controllers to create the 13/16-sector version). Almost the same thing exists today inside every Apple II and Macintosh in the form of an IWM chip, short for Incredible Woz Machine. Almost ten years of disk-drive technology have gone by, and Apple is still using the building block Woz made at Christmastime in '78.

Apple has declared the Apple II motherboard, Applesoft, and the video circuitry as the basic building blocks, and turned them into a two-chip set that went into the IIe and IIc and that now has been further reduced in the IIGS.

Next month, we continue our look back at Apple's first decade, and Apple's Vice President of Product Development Jean-Louis Gassée offers his thoughts on the next ten years. ✦