

8-bits™

***THE 8-BIT COMPUTER
COMPENDIUM***

FOR



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Atari 8-Bit Systems

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In 1979, Atari entered the 8-bit home game computer market with its model **400** and **800** computer systems. Using the MOS Technologies 6502 processor these units ran at a clock speed of 1.79 MHz. They were capable of rendering 256 colors of up to 320 x 192 pixel graphics and 40 x 24 pixel text resolution on a standard television. The model **800** was also able to use a composite video monitor. As far as sound was concerned, the **400** and **800** supported four 3 ½ octave range voices.



The **400** had a membrane keyboard, a single game cartridge slot, four controller ports and either 8kb or 16kb of RAM. The **800** had a full keyboard, dual game cartridge slots, four controller ports and either 8kb or 48kb of RAM. Both used the 10kb Atari Operating System ROM.

In 1982, Atari introduced the **1200XL** computer system. Using the 6502C processor still at a clock speed of 1.79 MHz. It had a true tactile keyboard, a single cartridge slot, two controller ports and 64kb of RAM. The **1200XL** used the 16kb Atari Operating System ROM.



1979

400 / 800

1982

1200XL

1983

600XL / 800XL

1985

65XE / 130XE

1987

XEGS

1992

In 1983, Atari replaced the **400**, **800** and **1200XL** with the new **600XL** and **800XL** computer systems. These systems, like many of the personal computers being introduced by Commodore, Radio Shack and IBM, came with the BASIC programming language built-in. Also in response to the personal computer, these systems had a parallel port to connect external devices to the system. The **600XL** came with 16kb of RAM while the **800XL** had 64kb of RAM. They continued to use the 24kb Atari Operating System ROM.



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In 1985, Atari made one final attempt to compete with the personal computer makers.



The **65XE** and **130XE** were introduced and were similar to the **800XL**, less the parallel port. The **130XE** upped the RAM size to 128kb. All continued to use the 24kb Atari Operating System.

In 1987, Atari made one last entry in the 8-bit game computer arena with its **XEGS** (XE Game Systems). Marketing these as *Game Systems* (the keyboard was optional) in one last attempt to differentiate itself from the 16-bit personal computer, Motorola, Zilog and Intel processor based, companies.



The 8-bit computer lost all remaining support from Atari by the end of 1991.

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***Atari Company
History***

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Atari was founded in 1972, by Nolan Bushnell a University of California engineering graduate. Bushnell became fascinated by computer games while in college, and felt that this fascination was not his alone. In 1971, he produced his first arcade game creation and named it **Computer War** (the game he saw in college was named **Spacewar**). His game was not well accepted and many people blame this on its complexity in the arcade venue in which it was used. Bushnell would not make the same mistakes twice and his second attempt was different in two major aspects. First, he would not use outside funding; and the most important lesson learned, the game would not be complex. Yes, the first successful video game **Pong** was born!

For an investment of what is thought to be only \$500, the Atari company was in business. Among its first employees were two young “technohippies”, Steve Jobs and Steve Wozniak (we’ll get back to this later). Bushnell earned \$3.2 million on **Pong** in its first year. By the end of 1975, sales exceeded \$40 million mainly due to the Sears distribution of the home version of **Pong**. By 1976, other companies had entered the home video game market with multi-game, full color machines. Bushnell sold the rights to **Pong** to Bally Industries to raise cash for the future growth of Atari. With this additional cash Atari developed **Sprint**, the first arcade game to use a computer processor chip. Bushnell was not content and wanted to bring this same technology to home gaming with what would become the **VCS** computer system.

Atari had overextended itself and development costs for the new **VCS** computer system had financially hurt Atari. It was about this time that one of the part-time employees mentioned earlier, Steve Jobs, approached Bushnell about funding a project he and Wozniak were working on in his parents’ garage. Bushnell had all available funding tied up in current Atari projects and the Steve duo had to find money elsewhere to form what became Apple Computer.

Other collisions in the Atari / Apple odyssey came to pass. Apple hardware not only competed with Atari in later years, but Atari systems were “closed” by design and difficult for third-party developers to create software for, while Apple systems were relatively “open” and third-party titles proliferated. Even game titles, which Apple did not encourage for fear people would not take their computers seriously, were on the increase. And even more “open” systems from Radio Shack, Commodore and others began to show up just when Atari was building market momentum. Do you think Atari means “bad luck” in some language?

In October, 1976, Bushnell sold Atari to Warner Communications for an estimated \$28 million. The **VCS** (renamed the **2600** in 1982) game console with color, sound and a new level of graphics was brought to market in 1977. The machine was an immediate success, grossing Atari \$128 million in 1978. Another “Apple phenomenon” began to surface at Atari in the midst of this success. Warner continued to impose its corporate culture on Atari. The free spirited, creative employees were forced to conform to the all-business Warner management style. Pretty soon everyone was leaving and going to

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competing companies. Bushnell, still serving on Atari's board as its Chairman was fired in 1978.

In 1979, the first true 8-bit home computer models (the Atari **400** and **800**) began to ship. These systems were designed around the MOS Technologies 6502 processor chip, the same chip used by the **Apple II** and Commodore **VIC-20** and **PET**. By this time the first Radio Shack **TRS-80** home computer designed around the Zilog Z80 processor and the Commodore **PET** (both with black and white video) had been on the market for more than one year. The line in the sand for graphics centric and business (i.e. data) centric computers had been drawn.

By 1980, Atari revenue had reached \$415 million and one-third of Warner Communications operating income came from Atari. But good fortune can be short lived in the technology industry. In 1980, Mattel introduced **Intellivision** for the sports game market (with the computer function as an add-on) and Radio Shack brought its **TRS-80 Color Computer** to market for the color graphics enthusiast. IBM introduced its personal computer (the definitive **PC**) in 1981. This computer using a 16-bit Intel 8086 microprocessor soon became the system of choice. Maybe due to the IBM name (who didn't want to run their business on an IBM system?) or maybe because it was a totally "open" design (those words again) the **PC** became the industry standard.

Of even greater significance to Atari in 1980 through 1982 was the birth of "software only" companies such as **Activision** and **Imagic** that developed cartridge based games for the Atari **2600**, **400/800** and Mattel **Intellivision** systems. These new companies hired many former Atari software developers. The result, in addition to the consumer benefits, were lawsuits and counter-suits.

Atari continued to invest in and improve on its 8-bit systems and ported many arcade games to its home systems. In 1983, Warner sold Atari to Jack Tramiel the founder of Commodore Business Systems. Under Tramiel, Atari continued improving the 8-bit systems in small evolving steps until 1987 when the last 8-bit systems were brought to market. They probably continued to be sold around the world for four or five more years.

In 1984, however, Apple introduced the **Macintosh** computer based on the Motorola 68000 microprocessor and 8-bit computing as a viable technology ended. But we hope that for those of you reading this compendium 8-bit computing lives on. It does with us for both the enjoyment it brings and the time in our lives that this technology represents.

Just about everything we did back then was fun...wasn't it?

- END -



The End of Atari

The articles that follow are from two former Atari employees that were there at the end. These articles were put into the public domain by their authors.

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Did You Hear Anyone Say "Goodbye"?

by Donald A. Thomas, Jr. (10/4/96)

It's odd to imagine an institution, which was as big and as powerful as Atari once was, to have been shut down in recent days. The real amazement for me is that it was all accomplished without a measurable flinch from within or outside the gaming industry. I can understand that gamers wanted to push Pong out the door early in the timeline. I can appreciate that the classics such as Missile Command and Asteroids do not push 32-bit and 64-bit systems to any technological limits. I know all these things intellectually, but the heart cannot face the truth that the world and the corporate machine known as Atari could not find an amicable way to coexist.

On Tuesday, July 30, 1996, Atari Corporation took each and every share of it's company (ATC), wrapped them all in a tight bundle and presented them to JTS Corporation; a maker and distributor of hard disk drives. On Wednesday, the shares were traded under the symbol of JTS. Within a few weeks, the remaining staff of Atari that were not dismissed or did not resign, moved to JTS' headquarters in San Jose, California. The three people were assigned to different areas of the building and all that really remains of the Atari namesake is a Santa Clara warehouse full of unsold Jaguar and Lynx products.

It was only as long ago as mid '95 that Atari executives and staff believed things were finally taking a better turn. Wal-Mart had agreed to place Jaguar game systems in 400 of their Superstores across the country. Largely based on this promise of new hope and the opportunities that open when such deals are made, Atari invested heavily in the product and mechanisms required to serve the Wal-Mart chain. But the philosophical beliefs of the Atari decision makers that great products never need advertising or promotions, put the Wal-Mart deal straight into a tailspin. With money tied up in the product on shelves as well as the costs to distribute them to get there, not much was left to saturate any marketplace with advertising. While parents rushed into stores to get their kids Saturns or PlayStations, the few that picked up the Jaguar were chastised by disappointed children on Christmas day.

In an effort to salvage the pending Wal-Mart situation, desperate attempts to run infomercials across the country were activated. The programs were professionally produced by experts in the infomercial industry and designed to permit Atari to run slightly different offers in different markets. In spite of the relatively low cost of running infomercials, the cost to produce them and support them is very high. The results were disappointing. Of the few thousand people who actually placed orders, many of them returned their purchases after the Holidays. The kids wanted what they saw on TV during the day! They wanted what their friends had! They wanted what the magazines were raving about!

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In early 1996, Wal-Mart began returning all remaining inventory of Jaguar products. After reversing an "advertising allowance" Atari was obligated to accept, the net benefit Atari realized was an overflowing warehouse of inventory in semi-crushed boxes and with firmly affixed price and security tags. Unable to find a retailer willing to help distribute the numbers required to stay afloat, Atari virtually discontinued operations and traded any remaining cash to JTS in exchange for a graceful way to exit the industry's back door.

Now that JTS has "absorbed" Atari, it really doesn't know what to do with the bulk of machines Atari hoped to sell. It's difficult to liquidate them. Even at liquidation prices, consumers expect a minimal level of support which JTS has no means to offer. The hundreds of calls they receive from consumers that track them down each week are answered to the best ability of one person. Inquiries with regard to licensing Atari classic favorites for other applications such as handheld games are handled by Mr. John Skruch who was with Atari for over 13 years.

In spite of Nintendo's claim that their newest game system is the first 64-bit game system on the market, Atari Corporation actually introduced the first 64-bit system just before Christmas in 1993. Since Atari couldn't afford to launch the system nationwide, the system was introduced in the New York and San Francisco markets first. Beating the 32-bit systems to the punch (Saturn/PlayStation), Atari enjoyed moderate success with the Jaguar system and managed to lure shallow promises from third-party companies to support the system. Unfortunately, programmers grossly underestimated the time required to develop 64-bit games. The jump from 8-bit and 16-bit was wider than anticipated. In addition, Atari was already spread thin monetarily, but were required to finance almost every title that was in development.

After the initial launch, it took Atari almost a year before an assortment of games began to hit store shelves. Even then, having missed the '94 Holiday Season, many of the planned titles were de-accelerated to minimize problems caused by rushing things too fast. Consumers were not happy and retailers were equally dismayed. The few ads that Atari was able to place in magazines were often stating incorrect release dates because that information changed almost every day although magazines deadline their issues up to 120 days in advance.

It was in 1983 that Warner Communications handed Jack Tramiel the reins of Atari. By this time, Atari was often categorized as a household name, but few households wanted to spend much money on new software and the systems were lasting forever. No one needed to buy new ones. That, combined with Warner's obscene spending, amounted to a *daily loss* of over \$2 million. Atari was physically spread all over the Silicon Valley with personnel and equipment in literally 80 separate buildings; not considering international offices and manufacturing facilities. Mr. Tramiel took only the home consumer branch of Atari and forced Warner to deal with the arcade division separately.

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Within a few years, Jack took the company public, introduced an innovative new line of affordable 16-bit computers and released the 7800 video game system.

To accomplish these miracles for Atari, Jack implemented his "business is war" policies. While people who publicly quoted his statement often felt that policy meant being extremely aggressive in the marketplace, the meaning actually had closer ties to Tramiel's experience as a concentration camp survivor. Of the 80 buildings in Sunnyvale, Santa Clara and Milpitas, almost every one of them were amputated from Atari's body of liabilities. The people, the work, the heritage, the history were fired or liquidated. Those who survived were unsympathetically required to fill in the gaps and while most tried, few actually found a way to be successfully do what a dozen people before them did. Atop the mountain, Jack pressed with an iron thumb. All Fed/Ex mailings were required to be pre-approved by one of a handful of people. "Unsigned" purchase orders went unpaid regardless of the urgencies that inspired their creation. Employees found themselves spending valuable time trying to find ways around the system to accomplish their jobs. Many of them lost their jobs for bending the rules or never finding a way to make things work. As horrible as it all sounds, it actually was the only way to protect Atari as a company and give it a chance to survive as it did and did very well.

Jack's introduction of the 16-bit computer was initially hearty in the United States but it went extremely well in Europe. Europeans were not accustomed to "affordable" technology and although the Atari computers were not IBM compatible, it didn't matter because people could afford them. Jack's private laugh was that the computers were sold at prices much higher in Europe than Americans were willing to pay. As a result, most of the machines made were being shipped to European destinations to capture the higher margin. This enraged the people in the United States that had been Atari loyalists. While waiting months for stores to take delivery domestically, international magazines were touting ample supplies. Those in the know within the U.S. became dismayed. The remainder never knew Atari was slowly abandoning the value of Atari's name recognition as it became easier and easier to forget some assuming Atari had long filed for bankruptcy.

On a technical level, Atari 16-bit computers were designed beyond their time. For less than \$1,000, consumers could enjoy "multimedia" before the phrase was ever really widely used. The icon-based working environment proceeded Windows popularity although the essential attributes of the two environments were very similar. MIDI was built-in and became an instant hit in the high-end music industry. Tasks were activated and manipulated with a mouse and the system accepted industry standard peripherals such as printers, modems and diskettes.

With all the genius that went into the technology of the machines, very little of equivalent genius went into the promoting and marketing the machines. Mr. Tramiel was the founder of Commodore Business Machines. When he introduced the PET computer in

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1977, Jack discovered he didn't have to call a single publication. Instead they all flocked to his door demanding an opportunity to see the product. News magazines. Science Journals. Business newsletters. Newspaper reporters. They were all there with microphone, camera and pen in hand. And they kept coming back. Adding a switch, announcing a new 4K application or signing a new retailer were all big stories the press wanted to handle.

Today, a new video game announcement may generate a request from any of the dozens of gaming magazines for a press release, but a lot of costly work has to be done to assure fair or better coverage. Editorial people are literally swamped with technical news. Samples are mailed regularly to their attention. Faxes fly in through the phone lines and e-mail jams up their hard drives. It takes a lot to grab their attention.

While Atari retained hopes to be successful with the Jaguar, Atari's marketing people were fighting established standards in the industry with severe handicaps. Since cartridges (the Jaguar was/is primarily a cartridge-based system) were so expensive, editorial people were required to return them before new ones would be sent. Editorial people like to assign review projects. So finding cartridges they sent out was not always easy to do. Additionally, reviewers often love their work because they get to keep what they write about. Regardless, the few magazines willing to cover Atari products were more often turned away because of a lack of programmable cartridges or any number of other indecisive barriers. In-store signs and posters were sometimes created, but many retail chains charge premiums to manufacturers that want to display them. Some direct mail campaigns were implemented, but Atari often could not afford to keep those things being advertised on schedule. Therefore, the advertisements were published and distributed, but the product was not available.

Clearly, Jack's experience with the world beating a path to the door of a company making a better mousetrap no longer applied. The world had revolved a few times beneath him and he never noticed. The tactics used to successfully sell Commodore computers were simply antiquated notions from the past. Meanwhile, Sony launches the PlayStation with over \$500 million in marketing funds. Today, the PlayStation is considered the most successful next-generation gaming machine throughout the world. Sony bought the market. Tramiel's Atari never learned how to do that. Actually, they never could afford it anyway.

After the 1990's got underway, Europe as well as the rest of the world, discovered that IBM-compatible computers were becoming more powerful and more affordable. The world always did want computers at home just like in the office and companies like Dell and Gateway exemplified the industry's trend toward home-based office computers. As a result, companies like Commodore, Atari and Next couldn't compete any longer. While the dedicated user base of each of them felt abandoned by these companies having to leave the computer market, the inevitable prevailed. Commodore jumped ship, Next changed business goals completely and Atari invested what they had left in the Jaguar

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game system. Even today, Apple is kicking and screaming. As good as Apple was at creating a huge niche for themselves, they focused more heavily on education. When kids grow up and get jobs, they want business machines. IBM was always the business standard.

When one examines the history of Atari, an appreciation can grow for how many businesses and people were a part of the game over the years. Chuck E. Cheese Pizza was started by Atari's founder, Mr. Nolan Bushnell. Apple Computer was born in a garage by ex-Atari employees. Activision was founded by Ace Atari programmers. The list goes on and on.

But for some pathetic reason Atari's final days came and went with no tribute, no fanfare and no dignified farewells. Why? Where did all the talent go? Where are all the archives? Where are the vaults? Where are the unpublished games and where are the originals of those that were? Why has no company stepped forward to adopt the remaining attributes Atari has to offer? Where are the creditors? What has happened to all the properties and sites? Where are the databases, warranty cards, promotional items, notes on meetings, unanswered mail? Who owns P.O. Box 61657? Who goes to work in Atari's old offices? Where do consumers have their systems fixed? Who is publishing new games? Who still sells Atari products? Why are there still a lot of people talking about Atari on-line?

I'm an ex-Atari employee and proud to have been. I'm still an Atari devotee and proud to be. To me, these are questions which all deserve an answer, but who will ask them?

The best people to ask these questions are those who have exposure to the public. If you believe Atari left us without saying goodbye, contact Dateline at dateline@nbc.com. If you REALLY believe, then send this article to 10 of your friends in e-mail. AND if YOU REALLY, REALLY believe, mail a few to newspapers or other news programs. A letter in your own words would be great!

I'd spend money for a thorough retrospect on Atari. Wouldn't you?

Wouldn't it at least be nice to say "Goodbye"?

- END -

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The More Things Change, The More They Stay The Same.

by Donald A. Thomas, Jr. (c)1997

A friend of mine dug up some old gaming magazines the other day. I'm talking about the ones published in the day of "Worm War I" (Fox Video Games, 1982) and "Fast Food" (Telesys, 1982) . . . early "eightiesish". Popular publishers included Atari and Activision, of course, but other names included CBS, Coleco, Data Age, Epyx, Froggo, Games by Apollo, Imagic, Konami, Milton Bradley, M-Network, Mystique, Mythicon, Panda, Parker Brothers, Sega, Spectravision, Tigervision, U.S. Games, Vidtec, Xonox and ZIMag. Those were the days when words like "sprites" and "pixels" were popularly used unlike terms like "polygons" and "MIPS". Sixteen-kilobyte game cartridges were accomplished by the virtues of bank switching and a slight screen flicker was a small price to pay for extra colors or added characters.

Just like my friend, I have some of those classic magazine issues in my archives too. It is fun to dig them out and recollect how easily impressed and challenged we were by raw simplicity. In fact, the entire industry was, relatively, uncomplicated back then. People with money flirted with a new generation of techno-tuned kids emerging from computer science classrooms. Many never finished college. They were romanced by the allure of dancing dots and the mystic way they tricked consumers into playing with them for money.

Over the years, the dots have matured from their modest origins. Only menacing paddles once accompanied them on screen. Now they have evolved into virtual worlds which possess no apparent boundaries. The monochromatic dots have been lost amongst their own collective mass of texture-maps and shading. As fast as a score might advance in the game of "Pong", beings possessed by virtual souls are now reborn by the will of the almighty gamer. The gaming industry has put the Land of Oz into everyone's grasp.

These magazines, the ones from the early eighties, are not just decorated with reviews and advertisements of software. Some pretty impressive peripherals and other related innovations abound as well. Some of you may remember the Joyboard (made by a little known company called Amiga). Gamers could stand on the Joyboard and steer skiers or nudge racecars by leaning in the direction the player wished to move in the game. There was the Game Brain as one of many devices that allowed several cartridges to be connected simultaneously. A simple switch could select any one of the installed cartridges.

There were video game organizers by ADI Electronics, joystick stands by Cable Enterprises, trackballs and bat-style joysticks from Wico and deluxe video game controllers from Starplex. There was the PlayCable and The Game Network online

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systems to download and play computer or Intellivision video games. There were wireless controllers, keyboard add-ons, screen overlays, joystick extension cords, system dust covers, light pens, 3-D helmets, printers, associated toys, trinkets, action figures, record albums and so much more.

As a sanity check, I breezed through my copies of "Video Games" magazine (Pumpkin Press, Inc.); August 1982 through October 1983. Every one of the items named above were advertised or reviewed in at least one of the issues. Then late 1983 and early 1984 slammed the shores of commerce and left an industry ghost town in its wake. Stores couldn't give away the glut of cartridges they had in inventory. In some cases, Drug Stores bought up the overstocks and offered them for no more than fifty cents each in huge bins at the front of their stores. Too many companies made too many titles all too fast. The consumer couldn't keep up with the flood and, quite frankly, had no interest anymore. The video games being spit out were becoming too similar and rarely unique. Although many were still relatively a challenge, there were only so many ways to make it fun pushing dots around on a television screen. The world became disinterested as companies such as Atari who reportedly buried hundreds of thousands of "E.T.; The Extra-Terrestrial" cartridges in remote landfills. One report I received stated that product was dropped in front of a moving truck to prevent any salvage efforts after Atari disposed of a stockpile of systems.

I don't know of any companies currently burying working product or smashing components against the pavement, but there are plenty of contemporary examples of products that didn't sell well on store shelves. And the cycle continues. A great game system emerges as kids begin to get bored with what they have. The world jumps ship from what was and switches to more, better and faster. There is no real brand loyalty. Each new system attracts enthusiasts, but the mass market sways to the pulse of technology and hype. The money flows in and out with the waves and the gaming industry benefits if they catch the high tide.

The more things change, the more they stay the same.

A friend of mine dug up some old gaming magazines the other day. I realize I made that point earlier, but I didn't mention my friend's observation. He said you could simply substitute the names from yesteryear with the names from today and the news is about the same.

He's right.

Unlike the movie and music industries, the gaming industry has never learned to grow up. The gaming industry continues to simply exist. Most sizable institutions implement open or covert events to help self-promote their own industry. The results mean that movie stars and recording artists, directors and their cinematic projects, concerts and premieres make news almost every day in popular media. The sports industry, lawn and

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garden, cosmetics, apparel and jewelry all have organizations established to make sure consumers are exposed to their commercial cause every day. In the gaming industry, almost everyone simply looks out for themselves.

Video gaming has become one of the world's most popular forms of entertainment, but also one of the least recognized. Consequently, no lasting compatibility standards have been established, new software often costs as much as a major car repair and no one really knows where the industry is headed for the long term.

So, what's new?

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Appendices

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Resources

Books

“101 ATARI Computer Programming Tips & Tricks”

Alan North, Paperback

“ABCs of the ATARI Computer”

David Mently, Paperback

“ATARI, Vol. 1 / Vol. 2 / Vol. 3 / Vol. 4”

Henry A. Taitt, Paperback

“Musical ATARI”

Hal Glicksman, Paperback

“Phoenix; The Fall & Rise of Video Games”

Leonard Herman; Paperback

“The ATARI Compendium”

Scott Sanders, Paperback

“The Soul of a New Machine”

Note: This book is not about game computers or Atari, but the message is the same.

Tracy Kidder, Hardcover

“Understanding ATARI Graphics”

Michael Boom, Paperback

Internet Sites

Technical / Hardware:

<http://pmwww.cs.vu.nl/home/ipoorten/Atari.8bit.Homepage/index.html>

ROM and Disk Binary File Pointers:

<http://www.concentric.net/~Twist/atari800win/>

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Atari 8-Bit System Features

Atari Model	Processor	Custom Chips				Memory	OS ROM	Interfaces				Sound Channels	Keyboard	Function Keys
		ANTIC	Video	POKEY	PIA			Cartridge Slots	Joysticks	Serial	Parallel			
400	6502	yes	CTIA/GTIA	yes	yes	8kb / 16kb	10kb OS	1 x 8kb	4	1	0	4 x 3.5 oct.	61 key Membrane	Reset, Option, Select, Start
800	6502	yes	CTIA/GTIA	yes	yes	8kb / 48kb	10kb OS	2 x 8kb	4	1	0	4 x 3.5 oct.	61 key Full	Reset, Option, Select, Start
1200XL	6502C	yes	GTIA	yes	yes	64kb	16kb XL	1 x 16kb	2	1	0	4 x 3.5 oct.	55 key Full	Reset, Opt, Sel, Start, Help, Fx
800XL	6502C	yes	GTIA	yes	yes	64kb	24kb XL	1 x 16kb	2	1	1	4 x 3.5 oct.	62 key Full	Reset, Opt, Sel, Start, Help
65XE / 800XE	6502C	yes	GTIA	yes	yes	64kb	24kb XL	1 x 16kb	2	1	1	4 x 3.5 oct.	62 key Full	Reset, Opt, Sel, Start, Help
130XE	6502C	yes	GTIA	yes	yes	128kb	24kb XL	1 x 16kb	2	1	1	4 x 3.5 oct.	62 key Full	Reset, Opt, Sel, Start, Help
XEGS	6502C	yes	GTIA	yes	yes	64kb	24kb XL	1 x 16kb	2	1	1	4 x 3.5 oct.	Optional	Reset, Opt, Sel, Start, Help

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The 8-Bit Computer Hall Of Fame



Apple II



Atari 400



Commodore PET



Commodore VIC-20



TRS-80 Model I



TRS-80 Color Computer



Glossary

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6502 - A processor chip developed by MOS Technologies in the late 1970's especially suited to graphics "intense" applications. Unlike the Intel 8080 or Zilog Z-80, the 6502 had very few registers. It was an 8-bit processor, with a 16-bit address bus. Inside was one 8-bit data register (accumulator), two 8-bit index registers and an 8-bit stack pointer (stack was preset from address 256 to 511). It used these index and stack registers effectively, with more addressing modes, including a fast zero-page mode that accessed memory locations from address 0 to 255 with an 8-bit address (i.e. it didn't have to fetch a second byte for each address).

6809 -The Motorola 6809 was a major advance over both its predecessor, the 6800 and also over the MOS 6502. The 6809 had two 8-bit accumulators, rather than one used in the 6502, and could combine them into a single 16-bit register. It also featured two index registers and two stack pointers, which allowed for some very advanced addressing modes. Other features were one of the first multiplication instruction sets of the time, 16-bit arithmetic and a special fast interrupt. This processor was first used in the TRS-80 Color Computer in 1980.

8-bits - The amount of computer memory needed to store one character of a specified size.

ANTIC - Alpha-Numeric Television Interface Circuit - A microprocessor used in game computers that is dedicated to the video display. It processes display data directly from RAM (DMA) and translates this data into instructions used by the CTIA/GTIA chip.

BASIC - Beginner's All-purpose Symbolic Instruction Code – A simple programming language designed by John G. Kemeny and Thomas E. Kurtz at Dartmouth College in 1963. Extensions to this programming language were used in the game computers to give programmers access to their unique features and functions.

BIOS – Basic Input/Output System – Used to initialize the start-up of a computer, perform self-tests on the hardware and load and run the full operating system (OS).

Byte - A sequence of eight adjacent bits operated on as a unit by a computer.

CPU – Central Processing Unit – Another name for the processor or microprocessor chip that combines all the basic functions needed to control a computer system.

CTIA – The Color Television Interface Adapter chip used in early versions of the Atari 400 and 800 computer systems. (see **GTIA**)

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DMA – Direct Memory Access - A facility of some computer architectures which allows a peripheral to read and write memory without intervention by the CPU.

FREDDY – The nickname given to the RAM address multiplexer circuit that establishes the clocking bridge from the processor to other devices. It was used in the Atari 130XE and XEGS systems. This has evolved into the clocking interface of the CPU and peripheral bus in modern computers.

GTIA – The Graphics Television Interface Adapter chip used in later versions of the Atari 400, 800 and all other 8-bit Atari computer systems. (see **CTIA**)

kb – Kilobyte – (2 to the power of 10) = 1024 bytes.

MHz – Mega-Hertz - Millions of cycles per second. The unit of frequency used to measure the clock rate of modern digital logic, including microprocessors.

MOS – Metal Oxide Semiconductor – A solid state electronic device, including the early 8-bit processors, made of certain types of material.

Operating System – The software that interfaces games and other custom programs to the hardware. This saves software developers the time of recreating the basic interfaces to keyboards, video, sound, joysticks and other input/output devices.

OS – see **Operating System**.

PBI – Parallel Bus Interface – Unlike serial ports that move data bits in a single stream, a parallel port or interface moves data bits in multiple, simultaneous streams.

PIA - Parallel Interface Adapter - An I/O chip used in Atari 8-bit systems. It consists of two 8 bit parallel ports with hand shaking lines. In the Atari, it has the following functions: game controller, port control (bi-directional), peripheral control and interrupt lines.

Pixel – Picture Element - The smallest resolvable rectangular area of an image. In a color image, each pixel has its own brightness and color, usually represented as a triple of red, green and blue (RGB) intensities.

POKEY – A nickname for the digital I/O chip used to control various bus and ports in the 8-bit game computer systems. This is the basis of the IRQ (Interrupt Requests) still used in most computers today.

RAM – Random Access Memory – The general term given to the memory used in all computers for holding program instructions and data.

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RF Interface – Radio Frequency Interface – Used to connect the video output of a computer to standard television receivers.

ROM – Read Only Memory – Non-volatile memory used to hold the operating system and other built-in programs such as the BASIC programming language in the early 8-bit game and personal computers. As the operating systems became larger and more prone to change, the ROM was used as an initializer (boot or bootstrap) to the full operating system. This is usually called the **BIOS** in contemporary computers.

Z80 – The Zilog Z80 processor was an 8-bit microprocessor. It was released in July 1976, with a 2.5 MHz clock rate (later version brought the clock rate up to 8MHz). The Z80 was a much improved Intel 8080 (as was the Intel 8085). It used 8-bit data and 16-bit addressing, and could execute all of the 8080 operation codes as well as 80 new ones, instructions that included 1, 4, 8 and 16-bit operations and even block move and block I/O instructions. The register set was doubled, with two banks of registers that could be switched between. This allowed fast operating system or interrupt context switches. It featured three types of interrupt mode. The Z80 also added two index registers (IX and IY) and relocatable vectored interrupts (via the 8-bit IV register). The thing that really made the Z80 popular was the memory interface that allowed the CPU to generate its own RAM refresh signals, which meant easier design and lower system cost. That and its 8080 made it the first choice of many systems.