# How the Altair Began

By Stan Veit

The story of the first true personal computer has many versions. It is over 20 years since the debut of the Altair 8800 computer in the pages of Popular Electronics Magazine, but everyone connected with it tells a completely different story. Truly, "Success has many fathers."

I (Stan Veit ) was the first (and last) Computer Editor of Popular Electronics magazine, and I came on the scene after the fact, but as one of the few people who was friendly with all of the participants, I am as qualified as anyone to tell the story.

The principals in the story are :

Leslie Solomon, former technical director of Popular Electronics, who is often called "The Father of the Personal Computer" (Les himself says he was more like the midwife.)

Arthur Salsberg, editorial director of Popular Electronics, who was responsible for publishing the articles that brought the Altair to the world,

Ed Roberts, the president of MITS Incorporated, who designed and built the Altair.

A supporting cast at Ziff Davis (publisher of Popular Electronics), and at MITS in Albuquerque, composed of Don Lancaster, Forrest Mims, and David Bunnell, who are well known in the personal computer industry, and a lot of people not so well known.

There are a few facts we are absolutely sure of and can set down as gospel truth. First, the Altair was not the first computer featured as a construction article in a national electronics magazine. That honor goes to The Mark 8 computer, designed by Jonathan Titus and published in Radio Electronics Magazine in July 1974.

Why, then, does the credit go to Popular Electronics and the Altair, which didn't come out until January 1975? I can think of two reasons: first, the Intel 8008 chip, used as a Central Processing Unit (CPU) in the earlier Mark 8, lacked some internal parts that are thought necessary to a microcomputer. Second, the Altair was offered as a complete kit, not just a list of parts to buy in order to make a computer. In those days it was almost impossible for anyone outside Silicon Valley, California, where the chips and other parts were made, to find the components necessary to build a computer. The 8008 microprocessor alone cost $150; the more powerful 8080 usually cost $300. In spite of these costs, Ed Roberts proposed to sell Popular Electronics readers a complete Altair kit for only $397. But I am getting ahead of my story.

Exactly how the Altair project got started is a major bone of contention. According to Art Salsberg, all the technical magazines knew about the development of microprocessor chips and they were all rushing to be the first to publish a computer construction project. Art says he had one of his contributors, Jerry Odgen, working on a microprocessor-based, digital, computer trainer article. Odgen had completed his preliminary work, but the project was not yet in publishable form. It was a "haywire mess" and needed to be cleaned up. When the Mark 8 article broke in Radio Electronics, Art Salsberg realized that the digital trainer was not good enough to counter the Radio Electronic article. He set about finding a better subject for a new project. Ed Roberts had written a construction article for a digital calculator, and the magazine had offered a kit of parts to the readers. This project proved very popular, but now calculators were selling below the kit price, and it was dead. Ed Roberts proposed to Art Salsberg that he design a computer kit using the brand new 8080 CPU chip. This would be a major breakthrough, so Art sent Leslie Solomon to New Mexico to investigate and report back to New York.

The Les Solomon version of the story was that he was traveling out west to visit his Indian foster child. He met with Don Lancaster and Forrest Mims, who wrote for the magazine. They introduced him to Ed Roberts, another contributor to the magazine. After a day of discussion, Roberts proposed the computer kit. Les told him that if the unit was attractive, did not look like a "hay wire rig," and it worked, he could get it placed on the cover of Popular Electronics, which would assure its success.

Another version of the story was told by Forrest Mims in the 10th Anniversary Issue of Creative Computing Magazine. In this version, Solomon was back in New York but knew that Roberts was working on a computer project. When the Mark 8 came out, Arthur Salsberg realized that he would have to publish a more sophisticated project than the stalled digital trainer from Ogden. He discussed it with Solomon, who mentioned that Ed Roberts was working on a computer. Art asked Solomon to call and find out if Roberts could get his project ready for a winter issue. Les Solomon called Roberts and was told that the project would be ready for the January issue. Later, Roberts called and said the computer would be housed in an attractive, multi-colored, Optima cabinet. With this, Art held up the Odgen trainer project, holding it as a back-up just in case Roberts did not deliver on time.

The important thing was that Salsberg and Solomon picked Ed Roberts and MITS to do the computer project, and Roberts was able to do it.!

The key to the whole computer project was the microprocessor chip itself. The 8080 from Intel cost $300 in small quantities; Ed Roberts was able to make a deal to get CPU chips for $75 in huge quantities (for that time,) providing he took chips with cosmetic defects. These are chips with surface defects that do not affect the electrical operation. This deal made the under-$400 kit price possible, but only if Ed could sell as many as 200 computers, which was his break-even point. This was an unthinkably large amount. Roberts was gambling that with the computer on the cover of Popular Electronics, enough of the 450,000 readers would pay $400 to build a computer, even if they did not have the slightest idea of how to use it.

Somehow, Ed Roberts and his small crew made the deadline, and shipped the computer to Les Solomon in New York via Railway Express, the normal, safe, and fast way to ship in those days. Only this time, Railway Express had a strike, went bankrupt, and completely lost the computer. It was never found.

To meet the deadline, Solomon had already started to write the first installment of the article, based on technical information supplied by Roberts and some photos taken before shipment. The Altair on the cover of the January 1975 issue of Popular Electronics was a dummy; there was nothing behind the front panel with its lights and switches. Salsberg and Solomon had stuck their necks out by a mile.

Meanwhile, back in Albuquerque, Ed Roberts had come up with a new design for the replacement machine. If you opened the January issue of Popular Electronics to read about the Altair, you would see a photograph of the lost prototype computer. In that photo, you can see that the computer was made of several boards stacked on top of each other and separated by spacers. There is no connecting bus at all. The boards were connected by ribbon cable. But when Ed Roberts built the new machine he included a bus board. This was a circuit board with 100-pin connectors. The mating circuit board had 50 "fingers" with electrical connections on each side of the board (making 100 electrical connections,) that could be plugged into a socket. This enabled the user to add additional circuit boards and thus expand the capabilities of the computer.

Because the Optima cabinet was so big, he provided for the addition of additional bus cards and built an 8-amp power supply. This was a very large amount of power for the time, and he never imagined it would prove too little to power all the features owners later demanded. The bus structure Ed Roberts invented was originally called "The Altair Bus" and later, the "S-100 Bus," a name Roberts hated because he felt it robbed him of the credit for his invention, and so it did. If you think about it, without the Railway Express strike and bankruptcy, we never would have had the S-100 Bus, and the foundation of a large segment of the personal computer industry which descended from it, including the IBM PCs.

The source of the very name "Altair" is also questionable. Les Solomon says that MITS tried to find a good name but couldn't agree and so called it the PE-8 (Popular Electronics 8-bit.) Solomon wanted to use a better name for the computer in his article. He asked his young daughter, who was watching Star Trek, what they called the computer.

"Computer," she answered.

"You are a big help," he told her.

So she said, "Why don't you call it Altair? That's where they're going this week."

And that's what they called it.

Forrest Mims said the name came from two editors of Popular Electronics in New York. One of them, Alex Burawa, who was an astronomy fan, said, "Its a stellar event, so give it a star name – Altair."

Ed Roberts added the numbers 8800 to the name because he intended to make later models. Thus, it became Altair 8800, and that's the name stenciled on the front panel.

The Altair articles ran for several issues of Popular Electronics, and as a result MITS was deluged with orders. To this day nobody knows how many computer kits were sold through the magazine, but Les Solomon told me he estimated over 2,000. That is more computers of one type than had ever been sold before in the history of the industry. Naturally, MITS was totally unprepared. They had hoped for 200 sales and received 2,000. Their small crew was totally swamped; they did not even have enough parts on order. There was no way they could deliver. However, when people were asked if they wanted their money back after 30 days, no one asked for a refund. They all wanted their computers - never mind about the money!

The flood of money being received at MITS catapulted them into serious business and they started to advertise in Byte, Creative Computing, Popular Electronics, and all the emerging computer magazines, selling even more Altair 8800s. In spite of slow delivery, people all over the country started to put together computers.

At one of the demonstration meetings held by MITS in Los Angeles, Dick Heiser became impressed with the Altair. He was able to persuade Ed Roberts to make him a dealer. Although Roberts did not have enough kits to supply the demand, he was forced to keep selling to keep the cash flowing. Heiser had a new idea about selling computers. With his wife, Lois, he opened Arrowhead Computers, a store selling computer books and Altair computers. Dick sub-titled his retail operation "The Computer Store" and this name caught the fancy of the press, giving him a lot of free publicity and inspiring many others to open computer stores.

What did an Altair buyer get for his $397 when he finally received the Altair kit? He got a box of parts, circuit boards, and some poorly written instructions. The manuals did improve, after Roberts hired David Bunnell as the Technical Writing Department, but you still had to be an experienced kit builder to put an Altair together and make it work. If you became completely mystified by the instructions, there was a phone number to call - if you could get through.

For those who were afraid to even start building a kit, you could buy a factory-assembled Altair for $498, but you had to wait much longer for an assembled unit than you did for a kit. No matter which you bought, you received an excellent cabinet, and a front panel with the name ALTAIR 8800 stenciled across the front. You assembled the 8-amp power supply, consisting of a transformer, switch, fuses, some rectifiers, controller chips, and a group of electrolytic capacitors, inside the cabinet. Then you installed the bus card. You carefully built the front panel and CPU by inserting the parts into the tiny little holes, applying solder so that you did not bridge any of the connections. This was not a job for the inexperienced or careless. If you applied too much heat you could ruin the chips, or even raise the plated lands off the board. If you did not use enough heat, you got a cold solder joint which plagued you ever after, and your computer probably would not work.

After they were built, the front panel board and the CPU plugged into the bus board, which was made with 50 parallel lines (or lands) on each side and four groups of holes that intersected the lands. Unless you paid extra, you only got two 100-pin sockets to solder into the bus card because you only received two circuit boards, the CPU, and front panel. You quickly learned to buy the two additional connectors for $15 each and install them when you first built the computer, because you would quickly need them.

When you bought your kit, you got no memory board or input/output board. All the memory that came with the Altair kit was 256 bytes (no, not "K-bytes"). All you could do with this was to play a game called "Kill The Bit" which had to do with trying to guess which front panel light would come on and trying to flick the switch before the light went out again. Actually this was a real indication that your computer was working. There was hardly any other way to tell.

If you really wanted to use your computer, you had to buy memory boards. You could get a 1K memory board in kit form for $97 ($135 assembled), a 2K memory board for $145 ($197 assembled), or a giant 4K memory board for $264 ($338 assembled.) In addition to memory, you would need either a serial interface board for $119 ($138 assembled), or a parallel interface board for $92 ($114 assembled), or both. One problem you didn't know about until after you built your computer was how much it cost to get a terminal for your computer to communicate with. The ideal was a Teletyper. These cost about $2,000 new for an ASR-33, a model which could act as an input device and a printer. In addition, it could punch paper tape which served as a data storage medium and read paper tapes into the computer. Even at the price of $2,000, you could not get new Teletype, which were built under contract a year in advance. Used, re-built ASR-33 machines sold for $1,200 to $1,500. Video terminals called "glass teletypes" were just starting to appear and they were beyond the dreams of Altair owners. MITS tried to build some terminals that hobbyists could afford, but they were not a success. Finally they made a deal to get some teletypes, without a stand and using their own interface, to sell to Altair owners for $1,500.

MITS also developed a cassette interface kit that worked with their serial board for only $120 ($174 assembled). This worked fairly well and was a big improvement over paper tape.

If you had 4K of memory you could run BASIC. This cost $150 unless you bought it with both a memory and I/O board from MITS. In that case it only cost $60. If you bought 8K of Altair memory, you could buy 8K BASIC for only $75; if you bought 12K of memory you could buy Extended BASIC (when it came out) for only $150. This was the famous BASIC written by Bill Gates (which is another story) and was not too bad a deal, except for the fact that the Altair dynamic memory boards did not work very well. The reason for this was that dynamic RAM needs to be electrically refreshed or it "forgets what it should remember." MITS took the refresh power from the CPU, a process known as "cycle stealing." Sometimes when the RAM needed refreshing, the CPU would be busy doing something else and the memory would be lost. MITS later replaced a lot of those early memory boards without cost, but the damage was done. People did not trust MITS memory boards, and bought static memory boards elsewhere.

If you did buy more than one memory board, you had to add at least another bus board and more connectors. The bus board they gave you with the computer kit only held four circuit boards. The CPU, front panel I/O board, and one memory board filled it completely. To add another bus board, you had to completely disassemble your computer, and solder 100 jumper wires to connect the new bus board to the existing one. Then you had to install the connectors into the bus board, making 100 solder joints for each connector. Finally, you had to solder the 100 new wires to the additional bus board. For every bus extender board, you had to solder 100 wires at each end. You had to be a soldering wizard to be a computerist in those days.

How About Software?

There were no operating systems to worry about. They came in much later, with floppy disks. There were operating programs, called Monitors, which did program loading, execution, and housekeeping, as well as some troubleshooting. There were also program loading routines called "bootstrap loaders." Getting software into the computer was somewhat complicated. First, you had to key-in a routine to initialize your I/O board. You did that by setting the front panel switches to represent a word in machine code (mostly octal). Then you pressed the Enter switch. You had to program the initializing routine word by word pressing "Load" after each word. Then you could load the "bootstrap loader" by reading in a teletype paper tape using the tape reader on the teletype, or an audio tape using a cassette interface. Next, you entered your monitor program, which was sort of a mini-operating system, again using the paper tape reader on the teletype, or the cassette interface. Now you were ready to load BASIC.

Everyone used BASIC in one form or another. Starting with 2K Tiny BASIC for the poor folks, and going up to Altair Extended BASIC (12K,) you had to use some form of BASIC to do anything. There was absolutely no application software in existence. BASIC programs were shared among users by publishing them in magazines or exchanging paper or audio tapes at clubs. Many of the first applications were simple games such as Hangman, Hammarabi, and simple forms of Star Trek.

So how did users get Altair BASIC (later Microsoft BASIC)? Simple. They invented "multi-user" BASIC, which in this case meant that one person bought the package, and ten others used it. Bill Gates and his partner, Paul Allen, had licensed their software to MITS on a royalty basis, and they were the ones who suffered. Gates sent an open letter to all the magazines, saying if computerists did not stop stealing his software, he would stop writing it. That did not work, so his solution was to get out of the bad agreement he had made with Ed Roberts. He then formed Microsoft to sell his software directly to users at a reasonable price. Bill Gates went on to become the world's youngest billionaire.

What Ever Happened To MITS Altair?

In 1976 and 1977, MITS was at the top of the heap. They were selling the Altair 8800 A and B models, plus a small 6800-based computer and a full line of peripherals. MITS had dealers all over the country and they could easily sell everything they could make. They ran multi-page ads in all the magazines and had the largest exhibit space at all the computer shows. Why isn't MITS the biggest personal computer company?

The problem was that Ed Roberts was a much better visionary and designer than he was a businessman. Starting with an organization of three people, he built a big company in a very short time. No one can take away from him the fact that he built and shipped more computers of one type than anyone else. He also developed new products at the same time he was setting up production, not an easy task. But Ed Roberts knew nothing about marketing and he made some serious mistakes.

Roberts gave Richard Brown the entire east coast of the United States as an exclusive territory. Brown and his partner, Sid Harrigan, planned to franchise computer stores all over the eastern territory under the name "The Computer Store" (which Dick Heiser had failed to register.) However, they sold only a few franchises. Meanwhile, other stores opened which would have sold Altairs if they could have gotten them. Instead they sold IMSAIs and South West Technical Products computers because that was what they could get. Thus, Roberts built up his competitors instead of keeping them out of the market.

In addition, Roberts took the automobile dealerships as his marketing example for Altair dealers. He insisted that his dealers could only sell Altairs. He was credited with saying "Ford dealers don't sell Chevies, so Altair dealers will only sell Altairs." However, he could not supply enough computers to keep the dealers in business. In addition, MITS continued to sell directly to end users even after their dealer network was in place. MITS was actually in competition with the dealers and could not stop because of cash flow problems. At that point, Ed Roberts' company could have attracted venture capital, or even gone public to raise money, but he did neither.

To make matters worse, MITS was in competition with two marketing geniuses, Bill Millard and Ed Farber of Imsai, who opened all the dealerships they could. Anybody who would put up $2,500 and promise to buy 25 computers in a year could become a dealer. Imsai actually delivered what they promised. When I opened my store, The Computer Mart of New York, (the first store on the East Coast) the first ten Imsai computers were there waiting for me, exactly as promised. I got all the computers I could sell, as long as I paid cash in advance for them. But the story of Imsai is another chapter.

The plight of the Altair dealers, and the internal cash flow problems became too much for Ed Roberts, although he could have worked them out. When Pertec, the disk drive manufacturer and principal creditor, offered to buy MITS, he sold out and retired from the computer business.

Pertec was a typical big business organization and did not understand the free-wheeling culture of MITS and the personal computer industry. However they did know that MITS was selling a lot of their disk drives. They saw MITS as a way to get into an emerging market. The businessmen who ran Pertec felt that the Altair name was tainted with the "hobbyist" designation. They wanted Pertec to be thought of as a "business computer company." They therefore dropped the name, which was the greatest asset they had, and the Altair disappeared from the market. Later, Pertec itself was brought by Adler of Germany and was absorbed by its parent.

The Altair did not disappear from the thoughts of the computerists and neither did the hardware they used. People hung on to their Altairs as old friends. Nothing will ever exceed the thrill of seeing the sign-on for BASIC printed on the teletype for the first time and reading the prompt "READY."

Ed Roberts went to Georgia and attended Medical School and also became a farmer. At one point, he got back into the computer business, producing a series of modular components to be used as building blocks in laboratories and engineering projects. This business did not survive in the face of off-shore competition.