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AN INTERVIEW WITH ONE OF TI'S ORIGINAL COMMAND MODULE PROGRAMMERS, HANK MISHKOFF

by Charles Good
Lima Ohio User Group

Hank Mishkoff worked on a lot of projects for TI between 1978 and 1983 relating to the 99/4, 99/4A and 99/8. As an independent contractor he wrote the code for some early TI education command modules, wrote the music for some modules (he is a musician), and wrote some of the 99/8 documentation. He also was an employee of Tronics, which is a company that sold 99/4A computers through multiple layers of distributors much like Amway home care products are sold today. In addition Hank worked in 1983 for Looking Glass Software and was involved in the creation of some of the never released ET command modules. What follows is compiled from a telephone interview and (mostly) from a number of separate internet email messages sent between Hank Mishkoff and Charles Good in late September and early October 1995. You certainly meet the most interesting people on the internet!

CG-- Tell me about some of the early work you did that relates to the TI Home Computer

HM-- I worked for TI as a programmer on the 99/4 in 1978, and then again doing documentation (and some programming) from 1980-1982. (Oh yeah, I'm also a musician; a lot of the music on TI's programs -- especially the early ones -- was mine.) For about a year after that, I worked with a company called Tronics, which sold the TI Home Computer on a multi-level basis. Following that, I did contract work on various TI products for years. I'm not an engineer, so I may not have the kind of info you're looking for; but I was involved with TI Home Computer products for quite a while, and I'd be happy to share my reminiscences with you any time you're interested.

CG The following is quoted from the June 1980 issue of FORTUNE magazine and describes the situation at TI in 1979 as TI considered developing an advanced version of the 99/4 to be called the 99/7. Any comments on this?

"Internal competition ultimately put the kibosh on the 99/7. TI's digital systems group, which is based in Austin and sells minicomputers to small businesses, argued that it should control development of the 99/7 because the machine was designed for small businesses. Besides, the 99/7 was so powerful and inexpensive that it would have cannibalized the low end of the minicomputer line. The squabble went all the way up to top management, which decided at the last minute to cancel the 99/7 introduction and transfer the project to Austin. There, the "not invented here" syndrome took over. Austin engineers started questioning the new product's

technical and economic feasibility, and within six months, most of the project staff had left for other jobs in TI. Looking back on all this, an alumnus concludes, "They threw away the two pieces of gold and kept the lump of coal."

HM-- Wow, this section is incredibly accurate -- I remember quite well when all of this happened.

CG-- Did you have anything to do with the 99/8 project?

HM-- Wow, does that bring back memories. I wrote the manual for that sucker; I didn't know that ~~any~~ of them were ever actually produced. I just went back and dug up an old invoice dated 7/7/83, in which I billed TI for my expenses in shipping them the final copy of the TI-99/8 manual counter-to-counter air freight (they must have wanted it ~~real~~ fast). If I remember correctly, I had worked on the manual all night (hey, I was a ~~lot~~ younger then), then drove to D/FW Airport in the wee hours of the morning to ship the manual to Lubbock. I seem to recall that the product was killed shortly after that; I doubt that the manual was actually printed.

Another nostalgia note: My invoice says that I shipped the manual to Monte Williams; Monte has since moved to Dallas, and now heads up Micrografix' documentation group.

CG-- I have the 99/8 book you wrote! I have rough, not quite ready for printing, "Final Draft 09/15/83" of the "TI-99/8, Book 2, Programmer's Guide for the Computer 99/8". Much of it looks it was printed on a line printer. It's about 300 pages. I can send it to you if you are interested, no charge.

HM-- I am definitely interested, thanks! That sounds like my book. It's probably slightly revised, since my records show that I shipped them ~~my~~ final draft in July.

CG-- I don't have a 99/8 but I know some people who do. One friend has a hex bus disk drive, an armadillo interface, and a whole bunch of special memory expansion cards that only work with his 99/8.

HM-- Well, I'm more amazed all the time. The very concept that you would personally know more than one person who has a 99/8 is stunning. Do you have any idea of how they got them? (Or why they would want them?) Did they work for TI?

CG-- Did you do any work on the 99/2? I have one of these, complete with a built in hexbus interface that can use all the little hexbus peripherals that TI sold, and some they

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never sold. I also have a "Mafertape digital tape drive", serial number 0000007. I can understand why TI never sold the things. Mine doesn't work at all reliably.

HM-- I don't think so. Let me take a minute here and search through some old invoices...

Nope, lots of charges for the 99/8, nothing for the 99/2. Did the 99/2 precede the 99/8? It seems to me that they provided me with a copy (possibly a draft) of the 99/2 manual, and I used it as the basis for the 99/8 manual. Maybe not.

 CG-- In the Spring 1988 Triton catalog NUMBER BOWLING is listed for \$11.95 as cartridge #1030. It is one of the modules shown on the video tape I am sending you. Did you work on Number Bowling?

HM-- I think I might have written Number Bowling, but I wouldn't swear to it. I worked on a few of the Scott Foresman programs, but I sure can't remember which ones right now.

 CG-- On December 15, 1994 Thomas Hartsig left a message on the comp.sys.ti internet newsgroup. He was commenting on discussions of recent sales and purchases by newsgroup readers of TI educational modules. "I wrote Addition and Subtraction 1 back in 1981. I had no idea people were still using these cartridges." Were you involved in that project?

HM-- I always thought that I wrote it, but I guess that depends on how you define "wrote." Tom designed the module and "wrote" the specification; I "wrote" every line of code that went into that module.

CG-- So why is Thomas Hartsig's name prominently displayed on the title screen of Addition Subtraction 1 and your name is found nowhere, not even in the documentation. Why are you given no credit?

HM-- Here's a funny story for you (well, I think it's funny, anyway)...

All of the programmers were miffed when we saw that Scott Foresman wanted to put Tom's name on the title page of Addition and Subtraction 1. Not that we had anything against Tom (we had never met him, for one thing; and for another, his contract with SF required that they give him onscreen credit), but we had all been developing programs for the Home Computer for years, and not once had any of us been given that kind of visibility. We weren't angry, but we were annoyed.

When I had completed a first pass of the program, I flew up to Chicago to show it to the folks at SF; I knew that Tom was going to be there also. (I think that was the first -- and possibly the only -- time that I met him.) Just as a joke -- and to exact some small measure of satisfaction -- I changed the onscreen credit from Tom's name to mine, mostly

to see how he would react (and, I suppose, in some obscure way, to make a point).

So I'm in the room with Tom and two folks from SF (Bob and Dee), and I fire up the program, and up pops the title screen with my name on it. I keep a perfectly straight face, like nothing's going on. Bob looks real surprised for a second, then he smiles, and I think he's going to laugh, but he covers his face with his hand for a second, and then he's got a straight face, too. And Tom, who is staring directly at the screen, doesn't react at all! I even find some excuse to keep the title screen up there for a few extra seconds to make sure he sees it, but there's no reaction. I figure that he's missed it, maybe he's been looking at the esthetics and hasn't noticed the switch. Bummer.

After a while, Bob and I leave to go talk about something else, leaving Tom alone with Dee. Later, Dee tells me that the second I left the room, Tom turned to her and said, worriedly, "I didn't know that Hank's name was going to be on the title screen!" Dee, who had figured out what I was doing, said something non-committal like, "I'll have to review that with Hank to see what's going on." I got a tremendous feeling of satisfaction after that; all I had been trying to do was to tweak Tom a little bit, and it had worked. Life is full of little victories!

 CG-- Did you do the music at the beginning of the Music Maker module? You can hear this music near the end of the video I am sending you. It is, I think, a Beethoven sonata.

HM-- It's possible; I'd have to hear it to be sure. Actually, the main reason that TI hired me was because of my background as a musician; my programming training and experience were pretty weak at the time. When I went to Lubbock for my interview in early 1978, they were in a position where they were making this revolutionary computer with three voices, and yet they had nobody on their staff with any musical ability. I hadn't mentioned my musical background on my resume, because it didn't seem relevant to a programming job. And TI couldn't tell me anything about the product (or even admit that they were working on a home computer) because the product hadn't been announced! Finally, in my very last interview of the day, someone asked me about the two-year hole in my resume. When I mentioned that I had been playing in a band, his eyes lit up -- although I had no idea why, and he couldn't tell me. Weird.

When I first started on the job, my first assignment was the Home Budget module; any experimenting with music was on my own time. I remember that I programmed the Minute Waltz to play in less than a minute -- it sounded terrible that fast, but it was a lot of fun. I also did a Bach two-part invention that was one of my favorite piano pieces; that may be what they later used on Music Maker. Then I started doing little bits and pieces for the Grammar module, which everybody liked so much that they decided to actually pay me for creating music (as long as I got my "real" work done on time!).

The piece I'm most proud of is a three-part piece I wrote for the Demo module. Unfortunately, they chopped it up and only used pieces of it. I've recently entered the entire piece into MIDI format; if you have some way to play MIDI, I can send you the file as an attachment, if you're interested.

C6-- Sure, send me the Demo module music in MIDI format.

HM-- Ok, here is the demo module music. I've attached three slightly different arrangements. I would have only sent you the best one, but I'm not at home, and I have no way to play them, and I can't remember which is which.

By the way, here's a funny story about that music, which was written for the Demo module. I left TI before the computer hit the market, and I was real excited when it finally began to show up in stores -- especially because a lot of retailers, having no idea of what else to do with it, just left the Demo module running in an "endless loop."

One day, I stopped into a computer store with some friends of mine, hoping to show off the computer -- and my music. They had the Demo program running, but the sound was turned off! I asked a salesman if they ever turned the sound up. "Yeah," he said. "When we're bad salespeople, they turn the sound on and make us stand next to the computer!" I had never realized that my wonderful music could get on your nerves after you'd heard it maybe 500 times...

HM-- Here's a long shot for you: When TI pulled the plug on Home Computer division, I was in the middle of writing a program that I believe was planned to be put into a "Command Module." I was writing the program as a subcontractor; the contractor was a company named Looking Glass. The program had to do with the adventures of ET; TI had licensed the character from Spielberg. Looking Glass had contracted to create 2 or 3 ET adventures; I don't remember the name of the one I was working on. I assume that, when the project went under, TI would have had a current copy of the code, and someone could have burned it into some EPROM's (the programs were pretty far along). Have you ever seen or heard of any program that might fit that description?

C6-- Which ones? Of those I know about one was just called "ET" and was a frogger like game where ET had to cross the highway, river, etc. to get to his space ship at the top of the screen.

HM-- Nope, that one doesn't even sound familiar.

C6-- The other, and maybe the one you worked on, is called "ET at Sea". It is a world geography game. ET has to move around a map of the world visiting cities and getting clues to the location of his space ship.

HM-- Now we're getting somewhere -- but that still isn't mine. Mine was called "ET's Adventures on Land" -- which I never would have remembered, not in a zillion years, if you hadn't jogged my memory with the At Sea title. If my memory

is accurate after all these years, the "At Sea" program was created by a programmer who worked for Looking Glass; his first name was Pete, but I can't remember his last name. (I vaguely remember that it was some kind of long Polish-sounding name.) His wife was also a programmer; she worked for a company in Richardson (a Dallas suburb) that did a couple of TI games, including one called MenHouse or something like that.

C6-- I have a video tape of these two modules, and other never released official 99/4A module software that I will be glad to copy and send you.

HM-- I would love to see that! The memory overload might prove to be fatal, but it would be worth it!

C6-- I have heard of "ET and his adventures on land" and always thought it was the frogger type game I described. Nobody that I have ever heard of has seen the "adventures on land" software.

HM-- I don't believe I was as far along on it as Pete was on the Sea module when work was discontinued. As I recall, I had programmed in all the little animals and animated them and given them paths to walk on, but the game didn't actually do anything when it was abandoned. You could move the animals around, but that was it. My guess is that nobody saved it because it was so incomplete.

Looking Glass Software (the company that had the contract for the ET games) was run by Gary and Mary Schenck (since then, they've been divorced, remarried, and divorced again), with whom I still speak every once in a while; if I remember, I'll ask them if they still have a copy of ET/Land, such as it was. Gary lives in KC (he's an art director for Hallmark), and I'm going to be visiting a client next week who has an office just down the street from his house; I think I'll give him a call.

STOP THE PRESSES!!!!

I was right in the middle of writing this note, thinking about what the chances were that Gary might have any idea where any of my old work might be, when it hit me that I might have some old stuff lying around -- and guess what I found??? I opened up one of my old diskette cases (this is starting to sound like the discovery of King Tut's tomb), and the diskette on top was labelled (in my handwriting) "E/A," which I assume means Editor/Assembler. The only project in which I ever used the Editor Assembler was the ET game, so I figured that I might have hit paydirt -- although I did work on the manual for that product, so the diskette might contain documentation, rather than code...

But here's what the labels on the other disks say:

ET LAND ("GROM7" crossed out) CODE FILES
 ET LAND ROM
 ET LAND ROM2
 ET LAND GROM3
 ET LAND GROM4

ET LAND GROM5
 ET LAND (*GROM7* crossed out) CODEFILES BACKUP
 ET LAND ROM BACKUP
 ET LAND ROM2 BACKUP
 ET LAND GROM3 BACKUP
 ET LAND GROM4 BACKUP
 ET LAND GROM5 BACKUP

Also, there's a sheet of paper with what looks like some coding equates for animals, homes, and food (12 of each); I'm thinking that maybe you were supposed to get each animal to its home and feed it (?).

Anyway, I'd like to mail this stuff to you, if you're interested and if you think you might be able to make some sense out of it (and if you think there's half a chance that the diskettes are still readable). Would you promise me to let me know what's on it before you make it public and let me "withdraw" some of the stuff if it turns out not to have anything to do with the Home Computer (like if I included a list of my ex-girlfriends and their phone #s...)?

 (Charles Good's added note:-- Hank did indeed mail these disks to me, along with the "ET and his Adventures on Land" programming notebook containing original graph paper drawings and notes of all the graphics in the game, as well as extensive dated notes concerning the conception and development of all the Looking Glass Software ET series of command modules. There were three planned modules called Land, Sea, and Air. The notebook contains little information on the Air game beyond its general concept. The Sea game exists in the Lima software library as GROM files that can be run with a gram device, as well as a slightly buggy version that works from extended basic. None of these three ET games are the same as the frogger type ET command module game, which was not a Looking Glass Software project.

The disks are TI DOS in SSSD format and contain lots of GPL source and object code for the Land game. There are no phone numbers of girl friends. The code is incomplete and the game is not functional. At Hank's request, I copied the disks (some were duplicates) and made a xerox copy of the development notebook, then returned all the originals to him.)

 C6-- Do I have your permission to give copies of your disks and notebook to others interested in the 99/4A?

HM-- Absolutely, although I must tell you that I have no idea whether or not I have any legal right to give you that permission. I suspect that Looking Glass (which doesn't exist any more) or TI may own the rights to the material. Practically speaking, however, I have a hard time imagining that anyone would care, at this late date, as I can't see that any of that stuff could possibly have even the slightest commercial value.

 C6-- The Looking Glass notebook you sent me has several pages that are headed "Conceptual development for TI/SDA education modules.." What does "SDA" stand for? I have a

never released TI module that says "Music SDA" on its title screen. It is the regular Music Maker module with extra code that allows you to get printouts of assembly source code, GPL source code, and Basic CALL SOUND statements that will produce the music you enter into the module. I have always wondered about the meaning of "SDA" in this module's title screen.

HM-- I don't have a clue what SDA means -- although you'd think I'd know, seeing as how it's in my notebook. I've forwarded your question to Paul Urbanus, the creator of Parsec, who's the only one of the TI Home Computer programmers that I keep in touch with; I'll let you know if his memory is any better than mine.

 C6-- I am today mailing back rate a VHS video tape with 6 hours of viewing. Included are many of the never released modules such as the ET stuff, a bunch of Bill Cosby commercials and pep talks designed for 99/4 and /4A retailers, and the official TI Retail Training video. There is lots of footage of the 99/4 (no A).

HM-- That sounds great. I remember seeing Cosby at a CES show in Chicago; TI had rented a ballroom as a hospitality suite, and he was posing for pictures with retailers. There was quite a long line, as I recall, of people waiting to be in some pix with Cos.

 C6-- I have a Tronics cassette tape set.

HM-- Which one? Do you mean audiocassette or program cassette? I was involved in both projects, so you may have some of my work after all.

C6-- Both audio and program cassettes. The audio tape has your voice on it! It was apparently made in 1982 and features you introducing yourself by name. The "Sights and Sounds" program tape credits you as one of the authors of this TI BASIC software

C6-- From a newsletter article I wrote a couple of years ago:

"TRONICS was created by Mike Wilcox and Dave Guardanapo to sell 99/4A's using a pyramid system of distributors and subdistributors, similar to the way ANWAY home care products are sold today."

Any comments?

HM-- Actually, Tronics was the brainchild of Jody Black, who was a Braniff pilot (a captain, actually) at the time. Pilots make a lot of money (he was pulling in 6 figures at the time, as I recall) and have a lot of free time on their hands (since they work only one out of every three days). Like firemen (who are in a similar situation, but with less money), pilots tend to get into other businesses on the side. And since he traveled so widely (and worked with a lot of

other people who travelled a lot, too), Tronics spread quickly all around the country. I knew Dave, and Mike's name sounds familiar, and they may have been successful Tronic distributors (for a while, anyway), but they were not involved in its founding.

Tronics always had trouble acquiring enough credit. Thus they had trouble keeping inventory and were very slow in delivering product to their distributors. This trouble delivering goods that had been paid for doomed the project. Eventually Tronics was sold. It went through several sets of owners. The last guys to own the company milked it dry, taking all incoming cash and delivering nothing. I had some involvement in advising a bankruptcy judge on the distribution of the company's remaining assets.

CG-- From my newsletter article: "Apparently TI knew about and approved of TRONICS pyramid sales scheme."

HM-- They knew about it, but were always a little leery of it. Actually, Tronics was an official TI distributor; they couldn't have done what they did without being able to purchase products at distributor prices. It took Jody a long time to convince TI to let him do what he did; many people were surprised that TI went for it at all. And Tronics was a "multi-level" company, not a pyramid scheme -- the differences are many and can be subtle, the main one being that pyramids are generally illegal.

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****DONE****

A SOURCE OF NEW (NOT USED) 99/4A COMPUTERS AND RELATED HARDWARE

I (Charles Good) recently talked to Darryl Dhein on the telephone. He is the husband of Ann Dhein who is known as the author of an excellent series of newsletter articles written a few years ago about drawing software for the 99/4A. Together this couple own Dhein's True Value Hardware of Waterloo Iowa. Several full page ads from Dhein's Hardware appear in various 1982 and 1983 issues of 99er Magazine.

They have the following TI computer hardware items available at their store. Everything is original new equipment. Please call or write for prices.

Beige 99/4A consoles with power supply and IV modulator.

Myarc memory expansion card with Myarc Extended Basic CorComp Floppy Disk Controller cards (DSDD capacity).

TI Peripheral Expansion boxes with flex cable interface.

Sorry, they don't have any Myarc Geneve computers or HFDC cards for sale.

****DONE****

WHY TI?

(downloaded from the comp.sys.ti internet newsgroup, dated September 25, 1995)

Pat, you are quite correct. By today's standards the 99/4A is primitive. However most of the people that still use it fall into 1 of 2 categories.

1) It suites their needs just fine and have no need to spend \$2K+ on a 'new' computer.

2) Are computer specialists, hackers, programmers ect. and play with it simply as a technological hobby. Sort of like the way old car buffs like to play with their old T-Bird or whatever. They do it because it is fun.

Most of us who fit into the 2nd category have many computers. I myself can easily walk between several platforms. My main specialty is Windows. But I still get a kick out of playing with a machine that can do in 64K what DOS still has trouble doing in 640K.

Since TI dropped out of this market 11 years ago the 99 4/a has had some remarkable things done to it by people who are quite talented. To name a few:

80 column cards with enhanced graphics and colors
SCSI interface adapters to access hard drives, CD roms etc.

101 key keyboard adapters

RAM disks

Memory expansion cards (256K and up)

The Geneve (a TMS9995 based compatible)

Very well written software such as

Teico (Terminal Emulator)

Funnelweb (Integrated Shell / Word Processor / Assembler / Disk Manager / pretty much anything else you would want on a small system c99 (a small c system)

Loads of games, graphics, paint programs, language extensions...

The list goes on.

Most of the people still involved have developed long time friendships because of their involvement in the TI. TI fairs still happen all over the world.

Maybe instead of giving that old system away you might pull it out of the attic and give it a second chance in life. If you are a programmer there are lots of fun assembly packages that you can use on it. In a world where programmers have to conform to an ever increasingly complex set of rules dictated by operating systems such as Windows, O/S2, UNIX, System 7.x ect. and the exploding size of the software that is being written, it is very refreshing to write programs in assembly for processor that is in many ways still superior to the Intel 80x86 family and not have to deal with to many constraints imposed by the operating system.

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If you are a hardware type there is nothing more open than the TI as far as architecture goes. Virtually everything you need to know about the hardware is available on line.

I will now step down off my soap box.
Happy Computing

****DONE****

THE BENEFITS OF PASCAL ON A 99/4A by Stephen E. Jacobs (sjacobs ainet.com)

(BB&P Editor's note: The article below is in response to an article by Charles Good on the TI implementation of the UCSD p-Code system on the 99/4A, originally published in the Lima newsletter in January 1994 and recently posted on the comp.sys.ti internet newsgroup. Mr. Jacobs' reply was emailed to us by the author on October 11, 1995.)

I feel the need to make a few comments about this piece. I haven't used my 99/4a for years but once was an enthusiastic supporter of the platform. I still have all my stuff--including a complete p-system software collection and, I believe, two p-cards.

I did a lot of programming of this system and even did a medical education program on the ti p-system. When I came to sell the program, I tried to do so using the IBMPC version of the p-system but it required buying their interpreter, so I switched to turbo-pascal...

There was once a thriving support group for the p-system and lots of software available commercially. The group was called USUS. In fact I still have a copy of their newsletter from July 1985 in which I wrote a "how to" article on using the p-system with the TI. They also once had a thriving forum on compuserve called MUSUS. I don't know if it is still there-- it got off into portable programming issues and I dropped out.

My comments are these: the p-system wasn't slow (at least compared to TI extended basic)-- it was much faster. Writing programs was a much slower activity (edit...compile...crash...edit...compile...crash...etc) but once written the programs were far faster than their basic equivalents.

Secondly there was lots of public domain programs available for the TI p-system via MUSUS. Their entire library was available on TI formatted disk and, if one had the compiler, they would usually compile without problems. The only difficulty was with the screen... most programs expected a 80x25 screen, so these programs would be a bit of a problem to use. I wonder what happened to all these programs?

Just my two cents on the matter...
Steve

****DONE****

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A great deal of credit for the information on the obscure cartridges listed in this series must go to the late Frank Bubenik, of New York, who was fortunate enough to have come across a TI Command Module Simulator, complete with the software, and to Dr. Charles Good, of the Lima, Ohio User Group, who shared that information with the rest of us in the User Group newsletter, after Mr. Bubenik sent it to him. Credit must also go to Mr. Mike Wright of Salem, NH for the original TI-Cyc, which was the first comprehensive listing of TI Cartridges.

CARTRIDGE HISTORY:

The concept of ROM cartridge use on a home computer, that is "burning" a program onto a Read Only Memory chip, and then placing the chip(s) in a quick connect/disconnect casing, did not originate with the introduction of the TI-99 Home Computer, nor for that matter did it originate with the introduction of the TI-99's greatest enemy, the Commodore VIC-20. In August 1976 Fairchild Camera and Instruments, a Palo Alto, California semiconductor firm, released Channel F, which was the first full-color home video game machine to use replaceable cartridges. Channel F came with hockey and tennis games built in and a port to accept new game cartridges as they were developed. On the heels of Channel F was Atari's Video Computer System (VCS) which also debuted in 1977. In June 1978, the \$895 Exidy Sorcerer personal computer was released with 8K of RAM, a 64 column by 30 row screen and the ability to use plug in modules which were the size of 8-track tapes. The Sorcerer appears to be the first "home computer" on the market to use ROM cartridges, though it was never to be a major player in the home computer cartridge software market.

The last computer built for ROM cartridge use was the
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Atari XE Video Game System, which was a reconfigured Atari 65XE that could be purchased as a game machine, but upgraded to a personal computer if desired. It was introduced at the Winter Consumer Electronics Show in January 1987. The major players in the computers-that-use-cartridges market were the Atari 400/800 computers, which were announced in December 1978, the TI-99/4 which was announced in June 1979, and the Commodore VIC-20, which appeared in June 1980. Other computers by these same companies also existed in the computers-that-use-cartridges market. These were computers like the Commodore 64, the Commodore 264/364, the TI-99/2 and the Atari XL line which included the 600, 800, 1200, and 1400XLs, as well as the 1450XLD and finally the Atari 65XE.

Of course there were other "computers" that used cartridge software such as the video game computers like the Atari VCS 2600 (VCS stands for Video Computer System), the Atari 5200, the ColecoVision Game System, Mattel's Intellivision and Intellivision II Systems, the Vectrex Arcade System and others. There were still other home or low-end computers that offered a ROM cartridge slot, but I have found it very difficult to locate much information on the existence of cartridge software written for these machines. Some of the computers I am referring to are the NEC PC-6001, the Spectra Video SV-318, and the Mattel Aquarius, all of which were announced or introduced in January 1983. Also, there are the late entries into the home computers-that-used-cartridges market like IBM's PC Jr., which appeared in November 1983, and the Coleco Adam, which appeared in October 1983. With the exception of the Atari 65XE, the introduction of home computers that used ROM cartridge software all but ceased by January 1985. There may be several reasons why cartridge slots were eliminated on newly introduced computers, but the most obvious one to me is the fact that the newer machines had more memory, which meant that cartridges simply weren't needed.

Cartridges may have been designed by some manufacturers to prevent duplication of software (TI comes to mind), but the biggest advantage they offered was their ability to bank-switch program code. This meant that large programs could (if written correctly) run in small memory machines. This was especially true of the VIC-20, which had only 5K RAM, but a ton of cartridge-based programs written for it. But cartridges cost much more to produce than a disk or cassette version of a program. When Commodore introduced the Amiga 500 and Atari the 520ST, it was the beginning of the end for cartridge using home computers. The final blow seemed to be IBM's loss of the copyright and patent on their PC's BIOS, which opened up the PC clone market in 1986. Once the flood of low-priced, high memory, PC compatible machines hit the market, there was no looking back.

Now before you get too excited and holler that the MSX machines from Japan (that were supposed to take over the low-end computer market in the U.S.) had cartridge slots, a look back at the home computer time line shows that the first

generation of MSX computers made their debut in Japan in November 1983. The supposed invasion of MSX computers was to have occurred beginning with the January 1985 Consumer Electronics Show, but it never happened. So, I'm going to stick with my assertion. As an aside, you might find it interesting to know that the MSX concept, though usually credited to the Japanese because they pushed it the most, was actually owned by Microsoft (MSX stands for Microsoft Extended) and it was based on the American made Zilog Z80A microprocessor used with TI's TMS9918A video chip.

Between the years 1979 and 1990 there were over 360 cartridges released or announced for the TI-99/4 and 4A. Of that number, about 275 are verifiable titles thus far. Honors for being the first cartridge produced for the TI-99 must be shared between several programs which were all ready for release when the TI-99/4 was first announced in June 1979 (Diagnostic, Demonstration, Beginning Grammar et cetera). Honors for being the first third-party cartridge for the TI-99 actually goes to four titles produced by Milton Bradley Company and released in December 1979. These were Connect Four, Hangman, Yahtzee and Zero Zap, all sold under the Gamevision banner. News of their impending release actually leaked out in August 1979 when Interface Age magazine reported their upcoming arrival. As far as I can tell, Yahtzee did not actually appear until the first quarter of 1981, despite the announcement, and despite the fact that the Milton Bradley Company included it in an 8.5" x 11" color glossy Gamevision flyer. The reason may have been attributable to the fact that Connect Four, Hangman and Zero Zap were all existing programs Milton Bradley had created for their ill-fated Microvision hand-held games playing machine (a prehistoric version of today's Nintendo Game-Boy), while Yahtzee was something new, and thus had to be created from scratch.

So far, honors for being the last cartridge to be produced for the TI-99 goes to Asgard's Extended Basic 3, which was released in the 4th Quarter of 1992. By my calculations, if a person had started their collection in 1979 and purchased every cartridge ever produced for the TI-99 up to the 4th quarter of 1990, at manufacturer's suggested retail price, that person would have spent over \$11,000 on their collection.

Almost 50 companies were involved in producing cartridges for the TI-99 at one time or another, some of whom never actually kicked a cartridge out the door (like Walt Disney), despite having finished the code for the cartridge. The most prolific producer of cartridges for the TI-99 was Texas Instruments, next came the Scott, Foresman Company, followed by DataBiotics, Milton Bradley, Atarisoft, Exceltec or Sunware as they were also known, Milliken Publishing, and Funware.

CARTRIDGES ANNOUNCED or RELEASED FOR THE TI-99, BY MANUFACTURER: NEXT PAGE

Bits, Bytes & Pixels

- Addison-Wesley 7
- Artios 1
- Asgard 6
- Atarisoft 16
- Broderbund 2
- CBS Toys 1
- CSI Design Group 1
- Control Data Corp. 1
- CorComp 4
- Data East 4
- DataBiotics 28
- DataSoft 1
- DLM 9
- Exceltec/Sunware 15
- Fox Video 1
- Funware 13
- Futuresoft 3
- Imagic 7
- IUG 1
- John Phillips 10
- Kantrnics 1
- Looking Glass 3
- Mechatronics GmbH 2
- Micropal 2
- Milliken Publishing 14
- Milton Bradley 22
- Myarc 1
- Navarone 20
- Norton Software 1
- Not-Polyoptics 1
- Parker Brothers 5
- Personal Peripherals 1
- Pilgrim's Pride 1
- Romox 7
- SNK Electronics 1
- Scholastic Inc. 4
- Scott Adams 2
- Sega 3
- Sierra On-Line 3
- Sofmachine 5
- Software Specialties 3
- Spinnaker Software 2
- Synapse 2
- Tex Micro 1
- Thorn-EMI 3
- Tigervision 10
- Triton 4
- Ultracom 1
- Walt Disney 4

Not all of the companies listed actually produced the programs or the cartridges they are given credit for in the above list. For example, the Walt Disney programs that were to be produced for the TI-99/4A were actually written by programmers at DLM in Allen, Texas, not programmers at Walt Disney Studios. In another example, the Face Maker and Story Machine programs that belonged to Spinnaker Software were not written for the 99/4A by programmers at Spinnaker. They were simply licensed to Texas Instruments by Spinnaker Software and then TI either used in-house or contract programmers to do the porting of the code to the TMS9900 chip.

For example, Jerry Spacek, owner of Intersoft (the firm that produced Defend the Cities), and John Phillips ported the Face Maker code to the TI-99. In the case of Story Machine, it was Bill Mann who did the programming that brought it over to the 99/4A computer. The same can be said for many other cartridge software programs for the TI-99. Some known authors and the programs they wrote are listed below:

PROGRAM-NAME	ORIGINAL PROGRAM	TI-99 VERSION
Alpiner		Janet Srimushnam
Arcturus		Bill Bies
Black Hole	Tom Griner	Steve Lampke/Ed Lee
Car Wars		James E. Dramis
Centipede	Donna Bailey	
Chisolm Trail		John C. Plaster
Choplifter	Dan Gorlin	
Crisis Mountain	Ron Aldrich	
	David Schroeder	

David's Midnight David Snider
Magic

Demolition Division

Brenda Lehman
Debbie Perich
Mary Anne Six

Demon Attack Rob Fulop (Imagic)

Dragon Mix

Mary Anne Six

Equations

John C. Plaster

Face Maker

Jerry Spacek

John Phillips

Neil McKenzie

Fathom

John C. Plaster

Fractional Numbers

Joyce Hakansson

Honey Hunt

Michael Archuleta

Hopper

John Phillips

Joyce Hakansson

I'm Hiding

John C. Plaster

Integers

John Phillips

Jawbreaker II

John C. Plaster

Measurement Formulas

Rick Levine

Microsurgeon

Miner 2049er

Bill Hogue (Dig 5 Software)

Mini Memory

Paul Urbanis

Minus Mission

Susan Powell

Munchman

James E. Dramis

Number Readiness

John C. Plaster

Picnic Paranoia

Russ Segal

Parsec

James E. Dramis

Paul Urbanis

Percents

John C. Plaster

QMAZE

Paul Urbanis

Reading Flight

Janet Srimushnam

Shamus

William Mataga

One last observation in the cartridge history arena; as 99ers we tend to think of all the great software titles available for the "other" computers that never made it to our machines because of TI's expensive software licensing policy on cartridge software. While that may have discouraged some manufacturers, my research leads me to believe that most of the real software "greats" of the early '80's didn't come from in-house programmers at the major software houses. Instead, they were written by home users, on home machines, and were simply marketed through the "big boys". And many of those early software "greats" were marketed on disk, not on cartridge. This tells me that other factors like the expense of the TI-99 peripherals may have also played a part in the TI-99/4A owner missing out on the bigger name programs.

In support of the assertion I can point to the DataMost attempt to port Zaxxon to the 99/4A in early 1983. When they couldn't get the program small enough to fit within the 8K limitation of a GROM port cartridge they abandoned the project. When asked why they didn't release it on disk instead of just abandoning the entire effort, the response was that DataMost didn't feel there were enough TI-99/4A disk systems in existence to justify the expense.

***DONE**