

## Horizon history outlined: Bud Mills discusses hardware

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*The following is the transcript of an interview with Bud Mills that was conducted by Gary Bishop. The original article appears in the February 1988 issue of MICROpendium.*

**MICROpendium:** Would you describe your product, and your service to the TI community?

**Mills:** The Horizon RAM disk circuit was dreamed up by Ron Gries. He put it together and made it work. Then Dave Romer and John Clulow wrote the software to control the card. Later some enhancements were made by Peter Hoddie. The card maximum size was 180K in the format that Horizon produced. Horizon made the card itself plus the software that controlled it. They really didn't want to get into the parts business, though. So I now carry all the parts for the card.

**MICROpendium:** How did you get into the parts business?

**Mills:** Well, when Clulow and Gries were putting together the initial hand-wired one, they paid like \$50 for one memory chip. Then the price went to \$37.50 per chip. So they bought a couple of those, and they kept adding to this one card. Then the price went to \$9 per chip. I said, 'if it's falling that fast, and you guys are still dealing with retail dealers, let me make a few phone calls.' My normal job does involve tracking parts. I had a vendor's license already. I was able to find a source and I bought chips for them for under \$5 each. That is when I locked in as their supplier.

**MICROpendium:** What were your original goals?

**Mills:** We looked at how many we thought could actually sell as a percentage of the number of P-boxes out there. So, how many P-boxes were built? The figure was near 300,000. If you take 10 percent of that, it would be 30,000. I figured there were about 10,000 that were in some state of active use. So, that's our market we were looking at, that 10,000. We figured we'd be real fortunate if we could get 10 percent of the active market. We did that, so far. That was our projection. Let's go back to 300,000 that were actually built. If the 10 percent rule still holds true, I'm going to sell a lot more cards. And I'm only scratching the surface. In two years' time we've sold over a thousand RAM cards, and I sold about 800 of the kits. You can buy the parts from the local parts houses. Last year I sold over 10,000 of the 8K chips. In two months, I've already sold over 1,000 of the 32K chips.

**MICROpendium:** So that's a pretty encouraging sign.

**Mills:** We're looking for it to pick up a little more. I still haven't mailed out any advertising yet. What I've done since the first of November is to put 40-45 HRD+ kits, or the 1 megabyte kits, in the field that have been built up and are viable. The beta test is complete, I'm secure with that.

**MICROpendium:** It seems you've done fairly well without any kind of heavy advertising at all.

**Mills:** I hope my reputation has been established. I've received very positive feedback from my customers.

**MICROpendium:** Would you describe the instructions?

**Mills:** The instructions are from Horizon. They made it so anybody that would buy their card would get the software and the instruction book with it. You could go out to the local Radio Shack and buy everything you needed. It would use standard parts. Well since then, Radio Shack quit handling a lot of the parts. I went into buying complete sets, 100 sets at a time, of all the parts except the memory. When I needed the memory, I'd buy that 10 or 15 kits at a time. So my investment would be relatively secure and I could package it because I didn't have a whole lot of dollars invested. Then I could sell at a savings to the TI community.

**MICROpendium:** Is a 3 megabyte RAM drive really necessary, or the best method to try to configure a system?

**Mills:** No, it's not going to provide you with the 100 percent ultimate machine.

**MICROpendium:** How does it operate?

**Mills:** The card file management is set up so you can configure up to 10 drives on a 1 Meg card. For 3 megs, you add additional layers of memory chips. This takes up more width in the P-box. The control lines are all there, the software will allow you to divide the RAM disk into 10 separate drives. Now, we only use two drive numbers, but every drive you configure has to have a drive name. Then, in accessing the RAM drive your system will automatically look for a drive name so it could be one of the upper drives. When you access that drive, it pulls that whole drive into the window of the second drive number.

**MICROpendium:** So it pages in and out of the drive number?

**Mills:** Right. Now the first drive number is set up to contain your menu program, disk manager, etc. You have 1440 sectors maximum on each drive name, until you run out of space on the card. So, with the 1 meg, you get two 1440 sector drives, and one 185 sector drive. Or you can have 10 90K drives.

**MICROpendium:** So this card you simply drop in the P-Box, can this card boot the system?

**Mills:** Not yet that I know of. The Geneve does a thing with the 8 bit data address and this card has a 16 bit data address that allows us to go to 1 meg. We can actually go to 16 meg as far as the addressing is concerned, but there are other drive limitations on the card.

**MICROpendium:** What is the maximum configuration you can have? You said the address scheme with 16 address lines you could go up to 16 megabytes, but for a kit we could purchase from you reasonably, is that the 3 megabyte kit?

**Mills:** I would not recommend going over the 3 meg line. You're talking \$600. That's pretty steep. Plus, at that amount of money, you can start talking hard disk. You can buy surplus hard disks, the 10 megs and the 5 megs, for \$50 or so. Right now, the biggest expense for a hard disk would be the controller.

**MICROpendium:** You sold these kits or cards at the Chicago TI Faire. What kind of reaction or success did you have there?

**Mills:** I took nine kits to Chicago. Of the full 3 megabyte kits, 2 of those went to Italy, and one went to Holland. Of the other 6, I went to Ottawa and most of the rest of them stayed in Chicago. Right after the Chicago faire I went up to Milwaukee and met Jim Schroeder. He is very active with the Geneve. Jim was showing how the Horizon card would boot the system. I said "Jim, check and make sure this 1 meg card is compatible with the Geneve." So he dropped it in the box and he did some formatting and he said "Oops." The Geneve will only

allow the card to be formatted to 1440 sectors, period. Then his software only accesses 1150 before it starts writing over and destroys your table. He said, "We ought to be able to fix that." I said, "Okay, Jim. Hang on to that card and see if you can't come up with a software patch that will patch the Geneve", which he did. The software is available on Genie right now to allow you to modify the SYS file for Geneve that will allow you to format an 80-track drive on the 1 meg card. But since that 80 track drive only uses 800K, I went ahead and made available an 800K HRD kit. There is no point in buying extra memory if you don't need it.

**MICROpendium:** So the bottom line at Chicago, was it was successful?

**Mills:** I sold all the cards I took there, plus I took orders for another 25 cards. There are actually about 20 cards in existence in the HRD + format. Of those there are probably 10- 1 Meg cards.

**MICROpendium:** What would be the minimum investment just to get into this?

**Mills:** The absolute bare bones minimum for a 96K RAM disk is \$140 from me. But for just an extra \$25, or \$165 total, you get all the way up to 192K. That's 6 of the 32K chips. Starting out with the bare minimum configuration would not be the most economical. The extra \$25 gives you the equivalent of a double-sided single density RAM drive. The increments from there on up is like \$11 a chip for each 32K. I've still got the 6264 chips, the console memory expansion, and then the individual chips here. I have since found some 200 nanosecond chips that are even cheaper yet, but I'm not sure we want to use those. The timing is usable. You could probably go 500 nanoseconds and be usable. But we wanted the Horizon to use only first class chips, such as the 120 or 150 nanosecond ones. We're using 150s in the 8K and 120s in the 32K console memory kit. We have been going with the better chips.

**MICROpendium:** You have a memory addition that gives you 32K directly on the 16 bit data bus. Is that correct?

**Mills:** Right. Physically, we are using two 32K chips. But actually, we are only using 16K out of each chip, because one chip sets across one half of the 16 bit data bus and the other chip sets across the other half.

**MICROpendium:** How about speed? Would this be any faster than the normal memory expansion? It's definitely cheaper.

**Mills:** Normal Multiplan recalcs are twice as quick. What happens is for the standard 32K, your processor sends out 16 bits, and then the interface says Okay, I'll take the first 8 bits, send it to the memory, take the second 8 bits, and send it to the memory.' So you've got all that interpolation time. We eliminate that. So you do get about a 49 percent increase in speed.

**MICROpendium:** Do you have any other projects going besides the 32K expansion and the RAM disks? Do have anything else on the burner? Anything you want to talk about?

**Mills:** Not really, I did get a hold of some of the proto cards and was putting together a kit for 8K DSR. What I'd like to see (John) Willforth and Western Pennsylvania group do is produce a clock schematic for use with their card plus a print spooler. And, if it looks like that's a reasonable project, and looks like there's enough demand for it, I'd stock parts for it.