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fish or foul at the I-O PORT.
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Editor Frederick Hawkins 432-5913

LEHIGH 99'ER COMPUTER GROUP

at last, at last

Inside this month's issue:

Firstly and foremost, the I-O Port is reprinting Joseph Nocera's "Death of a Computer". This article was first published in TEXAS MONTHLY's April 1984 issue and later reprinted in June 4 and 11, 1984 InfoWorld issues. That's where Alan Hewko read it first, and it was through his efforts that we got the rights to reprint it. Owing to its size, and ours, we're going three-up inside. So, be prepared: get out your magnifying glass or your reading specs and get the lowdown with names and places of 'Black Friday', before and after.

Then, from our far-flung NJ and sometime correspondent, a brief glimpse of the far edges of hitek ramdisks or more to the point (and this is how we get a verb into this sentence), Bob Kunkle reviews Foundation's 128K card with its newest wrinkle.

Nearer at hand, XEDITOR Dave Hendricks chews the fat and lean, and I think starts a new column under the heading of Nibbles and Bytes, renamed by me to Nibbles then Bytes.

And to tie this bundle with a knot back to its title, your (finally!) editor, having finally edited (!) nearly every nook with OPW, gets to bang the drums of BASIC, XBASIC, FORTH and maybe even AL.

OPW Deciphered:

OPW stands for 'Other People Writings', which any editorial stalwart prefers. Send yours c/o the POB, either formatted (you don't need titles, etc) to one of our column widths: compressed 45,55,63; uncomp'ed about 28, ELSE send a disk or tape with a TI WRITER or ED/ASM file. The last is preferred, because then we can EDIT.

same place, <>day:

Next meeting: MONDAY, OCT 15
Community Room, 1st Nat'l Bank
7th and Hamilton, Allentown
7:00 or 7:30 PM; I never get it right. Ask somebody.

The Lehigh 99'er Xmas Dinner Dance doth approach: Roast Prime Ribs or the succulent Seafood Combo, plus salad, etc and Dessert! Music for the non-lame. 20 bucks a head; bring your spouse for more chances at the doorprizes. Set off December 22nd's evening for us.

Quick march, ho!

1st: a different drum:

Those of you that have made some progress with TI FORTH probably have come up against this:

THE PROBLEM:

You're writing a program, testing it out, and saving it to the disk. You've the -EDITOR on-line and you're in and out of it, saving, LOADing, FORGETing and every now and then executing what you've written. Suddenly, you discover you've reLOADed the wrong SCREEN.

WHAT HAPPENED?

Given no typos, a clear head, and a steady hand you've changed your number BASE. HEX has its advantages, particularly when you need an address or a character description (even BASIC users recognize this aspect). Howsomever, the -EDITOR has a flaw (and it's intentional) in that the SCR # is always in DECIMAL. Disaster lurks in this circumstance, especially given the BASIC user's nominal security when it comes to disk files. Try SCOPY or SMOVE sometime without checking your numbers....

SCREAM & SHOUT, RUN ABOUT

The practiced FORTH user, on the other hand, doesn't give it thought. Well, mostly. Anyone would have problems with moving SCREENs about to the seemingly correct place, only to discover they ended up on the only version of another important and obscure word. The lauded and proclaimed FORTH user, (the one in the books), realizes that FLUSHing after each change isn't necessary:

> After getting the SCREEN into the -EDITOR's buffer, FORTH keeps track of any change. It toggles a flag when a SCREEN has been updated, and will send it to disk if required.

The books, however, point out that the P. FORTH user FLUSHes after most every little change in a SCREEN, out of habit and because system crashes (read wrong algorithm) so easily. (A BSAVEd system disk is handy, instructions will follow.)

THE FIX & WHAT ABOUT BASIC, anyway?

I'll leave the -EDITOR fix for next page, because I want to catch the BASIC user's eye. This issue, once deferred, has been touted as a would-be FORTH and AL issue. One might be tempted to scan it for ads and

marching with a tin drum, cont.

gossip, and toss it. DON'T! Here's why:

Taking a long term view, if you've used your computer for about 100 hours without a hardware glitch, the thing will be good for another 20 or so years. Peripherals will wear out in that time -- disks, drives, tapes, and perhaps a RF mosulator or transformer. But, aside from the sinister-cartridge-slot-syndrome, the real computer will hang in there.

None of these failures makes it worthwhile to throw it all away and get new. Advertisements notwithstanding, until we get some real progress in software, a newer machine will not do anything substantially different than the 4A. And until they do, there's little justification in tossing what you've learned.

Twenty years is a long time to learn about this tool. Indeed, long enough to learn everything there is to know, even all of these extras. Part of that learning will consist of knowing where to look. Hopefully, this newsletter (and others) will be one of those places.

What has this to do with BASIC?
Quite a bit, really. To swipe a thought from Aesop, (of Fabled fame), it's the same elephant no matter from which blind side you approach it. That learning will sometimes consist of testing out guesses made on the basis of what another language does, and then trying to duplicate it in the language you use. A little further on, we'll serve up at least two examples, but first back to FORTH:

2nd: the -EDITOR fix:

Perusal of the Screen Editor's own SCREENs is an education. In fact it isn't a big deal, after all. There's only about 35 words on the five screens and over half move the cursor about, or fiddle with it somehow. The workhorse word, VED, is an minor in PhysEd, if not a textbook case of how you ought to arrange a program to do different things when you press a key. [The adventurous ought to try to make VED have an auto-repeat function. The place to hack around is KEY -- you'll want to use ?KEY somehow].

So, changing the DECIMAL SCR # to the current number BASE is merely a matter of finding the right word and EDITing it. There are philosophical holes to fall in here, using -EDITOR to change -EDITOR, but that's FORTH. The word is LISTA (SCREEN #34) that puts the current block number up and throws the left hand number grid up there as well. LISTA is part of LISTL which you'll note puts the top row of numbers across the screen, after it saves the BASE, then resetting it on the way back. LISTL, in its turn is part of VED (the workhorse on SCR 38). VED is the last word in EDIT and WHERE. Those two and ED@ are the TI FORTH vocabulary words that we ordinarily use when using the -EDITOR. It's just the snoopy and newsletter editors who ever look for the others. In fact, if you VLIST when you have the EDITOR and -DUMP on-line, you won't find VED or LISTA or LISTL or the rest. That is, not until you execute the word EDITOR1, which calls up the -EDITOR's vocabulary. That's one of the other things that EDIT, ED@ and WHERE do.

Old LISTA ---:---New LISTA

```
: LISTA                    | : LISTA
  DECIMAL 0 0 GOTOXY       |   0 0 GOTOXY
  DUP SCR !                |   DUP SCR !
  ." SCR # " . CR CR CR    |   ." SCR # " DUP .
                           |   ." (in decimal= "
                           |   DECIMAL . ." )" CR CR CR
  16 0 DO I 3 .R CR        |   16 0 DO I 3 .R CR LOOP ;
  LOOP ;                   |
```

The new LISTA just puts off the change of BASE until after it prints the SCR # in the current BASE. Interestingly, this means that BASE->R (in LISTL) doesn't change the BASE in of itself, nor, upon reflection, can it. After you've changed LISTA, the word to FORGET is EDITOR1, then use the MENU's -EDITOR again. For a quick and dramatic demontration, try

```
2 BASE ! ED@
```

That will show LISTA's SCREEN again, with a binary SCR #.

By the way, if you've always been bothered by the next and previous SCREEN keys -- FCTN 4 and 5 -- where you press the lower numbered key to get the higher numbered SCREEN, flipping them is a four character change. Simply find this sequence on SCR #38

```
02 0F +SCR     and change the     0C 0F +SCR
0C 0F -SCR     respective cases: 02 0F -SCR
```

And finally, while we're going by the ways, only one word in the EDITOR1 vocabulary contains a resident FORTH word to access the disk. One would have guessed that much of -EDITOR would have to do with belaboring the disk, but that part is like a small town seen from the Superchief -- if you're not looking, the whistle is all you know of it.

THAT'S no drum at all!
XBASIC, this time: This routine has been kicking around since A9CUG CALL Newsletter published it in June. I had thought it was a Gary Matthews' item but

step lively now, cont.

on rechecking, I'll have to classify as -Anon. It demonstrates what happens to XBASIC if you learn something of the console from an assembly language viewpoint.

(Editors and promulgators, please note: As orginally published, the poke address was -31332 which works out to HEX >859C. And where the hell THAT came from beats me. Anyway, the legitimate address is >8400 or -31744. True enough, the first works and I suppose you could say it shows how the memory-mapped block is as TI says : 'only partially decoded. Thus, the devices will respond not only at the base addresses ... but also at other addresses within the 1K block.'
-- TI99/4A Console and Peripheral Expansion System Technical Data, write to Texas Instruments Inc, Attn: Dealer Parts Department, POBox 53, Lubbock, TX 79408. (This manual has the best description of how DSRs work. That depart. is a new one to me, from Steve Ciarcia's 'ASK BYTE' Sept column. More about Steve later.)

I shan't explain which device this is, and further recommend not running the program until you've got all in. If all goes well you're in for a real surprise. Didn't know the ol' box had it in it, did you?

BLACK BOX DIRECT MEMORY LOADER

```
4 CALL INIT
8 FOR A=1 TO 255 :: CALL LOAD(-31
744,-A):: NEXT A
12 FOR A=1 TO 255 :: CALL LOAD(-3
1744,A):: NEXT A
16 FOR A=1 TO 255 :: CALL LOAD(-3
1744,A):: NEXT A
20 FOR A=1 TO 255 :: CALL LOAD(-3
1744,-A):: NEXT A
24 FOR B=1 TO 5
28 FOR A=1 TO 255 STEP 4 :: CALL
LOAD(-31744,-A):: NEXT A
32 NEXT B
36 PRINT "2ND HALF" :: CALL SOUND
(100,110,0)
40 FOR B=1 TO 5
42 FOR A=1 TO 975 STEP 4 :: CALL
LOAD(-31744,A):: NEXT A
44 FOR A=1 TO 255 STEP -5 :: CALL
LOAD(-31744,A):: NEXT A
48 NEXT B
```

For background material and help in understanding this gimmick, read section 20 of the Editor/Assembler manual. That's the chapter, 20.2 is likely the verse.
>Frederick Hawkins

nibbles, then bytes

Lifeboat Associates says it will continue producing and selling software for discontinued computers. In particular, Lifeboat will support the TI-99/4A, Osborne I, and Victor 9000 computers. For a catalog, Write to Lifeboat, Dept. C, 1651 Third Ave., New York, NY 10128.

Coming soon to a TV screen near you, the FAMILY COMPUTING TV SHOW to be broadcast on the Lifetime Cable Network. This will be a 26 program series. Anyone with ideas, comments, suggestions, or questions about the show can write to "FAMILY COMPUTING TV Show" 730 Broad way, New York, NY 10003.

By popular demand, COMPUTER SHOPPER has compiled the "Innermost Secrets of the TI99/4A", Randy Malcomb's series, into bookform and is offering it to 99 users. Randy's series dug into the TMS 9900 microprocessor, and gave tips for assembly language programming. At only $5.95 it's got to be a bargain. To order yours pick up a copy of COMPUTER SHOPPER and check the AD for yourself.

I've mentioned in previous newsletters about the 'online news letter' called SUBFILE99 available on the SOURCE. Here's a rundown of what was featured in the August issue:

The first thing I downloaded was the SUBFILE99 DOWNLOADER. This program is similar to the TRANSL program in our August newsletter. In fact, I used TRANSL to translate downloader! TRANSL did require me to key in the excess line length used in downloader, but it sure beat typing 137 lines! Downloader has all the instructions, beeps, and bells needed for even me to use it without getting confused.

Another useful program was FTRAN, a set of 12 FORTH screens which allow you to transfer DIS/VAR 80 files into code that is readable by the FORTH system disk. This is the same as the Downloader only it is for use with FORTH programs. FTRAN makes it easy to trade FORTH programming via the TE II. Also included was a FORTH DISK-CLONER, a useful tool if used for the right purposes!!!

There was a section on ONE LINERS which featured DEF statements commonly used in TI BASIC & XBASIC. This column should help you with your programming. It also featured a rather long program using this month's one-liners. SUBFILE99 also included sections on subroutines complete with a demo program, CALL LOADs, software reviews, a rumor mill, and other such goodies. September's update (due online Sept 7) will include an improved FTRAN, a FORTH loop demo, an interview with HCM, an XBASIC program editor, recovering blown disk files, and more. SUBFILE99 could really affect my cashflow, considering the access time involved.
>Dave Hendricks

JOSEPH NOCERA'S "DEATH OF A COMPUTER" is reprinted, with permission, from the April issue of TEXAS MONTHLY.

DEATH OF A COMPUTER

BY JOSEPH NOCERA
Texas Monthly

Almost immediately, people at Texas Instruments were calling it Black Friday. Early in the afternoon of October 28, 1983, the rumors began to fly, and at the company's Lubbock, Texas-based consumer-products group, the rest of the day was chaotic. Middle managers called employees in, a few at a time, to tell them that yes, it was true and there was nothing that could be done, and then everyone in Lubbock was on the phone to friends at all the other TI facilities, and by 4:00 P.M., when the official corporate announcement was released to the press, there wasn't a soul at the company who hadn't heard the bad news. Texas Instruments, the company that had put more computers into American homes than anyone else, was pulling out of the home-computer business.

Who could have imagined that it would end this way? Only a year earlier the consumer-products group had been the toast of Texas Instruments, and the TI home computer, the 99/4A, its biggest success. Back then, TI people talked about the 99/4A with awe. It was destined to dominate the home-computer business, they said. It was going to reach $1 billion in sales. It was going to be the biggest winner in the history of the company. Back then, TI assembly lines in Lubbock were cranking out 5,000 computers a day, and that still didn't keep up with the demand.

It wasn't suddenness alone that made the 99/4A's fall from grace so stunning. Texas Instruments was a proud and stubborn company that had helped spark the electronics revolution. It was not accustomed to failure.

Texas Instruments had always been the world's largest maker of semiconductors, but in 1983, for the first time, it was outproduced by Motorola. Texas Instruments had practically invented the digital watch, but several years ago it could only stand by as its watch business was swept away in a flood of foreign imports that were not only cheaper but also better.

The home-computer fiasco made these other difficulties pale by comparison. In just two quarters of 1983 the 99/4A cost Texas Instruments an astonishing $400 million in corporate losses. In July, problems with the 99/4A forced TI to post the first quarterly loss in its 50-year history. On Wall Street TI stock dropped 39 points because of the home computer.

Nobody likes to dwell on failure, least of all Texas Instruments, so it is no surprise that the company officially "declined to cooperate" with this account of the rise and fall of the 99/4A. The two men most responsible for the decision to get out of the home-computer business — chief executive officer Mark Shepherd and chief operating officer J. Fred Bucy — were unavailable for interviews.

In 1975 the personal-computer industry was still in its infancy. Apple was a tiny company operating out of its founder's garage; IBM hadn't even considered getting into so nebulous a venture; the handful of people who bought computers were mostly technology buffs. That year Texas Instruments introduced something called the TMS 9900 microprocessor chip, which would eventually spawn the 99/4A computer.

Although selling consumer items like pocket calculators and computers is what gives Texas Instruments visibility, the company's biggest profits have always been made in less glamorous ways, chief among them the manufacture of silicon chips, which it sells in huge lots, at low prices, to other companies. Getting the volume up and the price down has always been the linchpin of TI's sales strategy. And so it was with microprocessors.

Although TI did not invent the microprocessor — the credit for that goes to Intel — the company quickly asserted its superiority in the marketplace with its first chip, introduced in 1974, a 4-bit chip called the TMS 1000. This soon became the most ubiquitous chip in the business, used in video games, calculators, microwave ovens, and hundreds of other electronic products; to date, more than 100 million TMS 1000s have been sold.

TI's second-generation microprocessor was the 9900, but though it was a quantum leap technologically, it was a flop in the marketplace. It failed in part because it was too far ahead of the field; while Intel and everyone else was just beginning to make 8-bit microprocessors, TI leapfrogged them and made the 16-bit 9900. The idea was that the 9900 would make the 8-bit obsolete, and this new TI microprocessor, like the TMS 1000 before it, would become the industry standard. Instead, the industry flocked to the 8-bit microprocessors and left the 9900 dying on the vine. But to back down and build 8-bit microprocessors like everyone else was an abhorrent idea for TI, a company where managerial decisions are shaped by an internal framework that is a culture all its own.

The Texas Instruments culture is at once the company's greatest strength and its greatest weakness. It was the culture that made it possible for TI to rise from its beginnings as a small, geological-service company and become a $4 billion electronics giant. TI engineers tend to live near each other and spend most of their free time in each other's company. Many of them come to TI straight out of college — TI doesn't like hiring mid-career outsiders. Their loyalty to TI is fierce and total. In return, TI gives its engineers what amounts to lifetime tenure; they are rarely fired.

TI is run by engineers for engineers. Both Shepherd and Bucy began their TI careers as engineers, and almost all of its top managers have engineering backgrounds. Thus, they understand the needs of engineers — the need for autonomy, for instance. Despite the company's size, the TI chain of command is quite short, and Bucy and Shepherd try not to get in the way of managers who are doing well. The company never skimps on its research and development budget, no matter what its cash-flow needs might be. R&D, which is what engineers live for, is at the heart of Texas Instruments' technological success.

But engineers have other, psychic needs, and these too have become a part of the TI culture. One is the desire to accomplish things from scratch rather than using existing products. At TI this frame of mind has led to an obsessive dislike of — and even contempt for — other companies' products. Thus the same TI culture that spawned breathtaking innovation also spawned less attractive traits, — like arrogance and corporate hubris — that hurt the company. TI didn't just want to be competitive in the markets it entered; it wanted to dominate them.

Given that corporate culture, there wasn't much doubt that TI would stand by its own microprocessor, the 9900, rather than conform to a marketplace that wanted eight bits instead of 16. The preferred solution was to find an internal use for the 9900 that would make it profitable. One possibility was to build a consumer product, a computer, that would be driven by the 9900 microprocessor. It was a classic Texas Instruments solution — TI divisions have always been able to post profits by selling components to other TI divisions — but it also meant that TI would be building a computer to fit its microprocessor rather than the other way around. Though no one could know it at the time, the TI culture had just led the company into its first big home-computer mistake.

By 1977 the lengthy research and development process was in full swing. The consumer-products group, which designed and manufactured Texas Instruments pocket calculators and watches, was given the assignment of coming up with the next product and was also given spacious new quarters in Lubbock. Moving to Lubbock from company headquarters in Dallas was Bucy's idea, Texas Instruments' No. 2 man and the consumer group's longtime guardian angel. Bucy is a native of Tahoka, only 29 miles from Lubbock.

Within the consumer division, the move was quickly seen as another mistake, for it turned out to be very difficult to persuade computer engineers to move from Silicon Valley, less than an hour's drive from San Francisco, to Lubbock. But the bias against outsiders and the company's do-it-ourselves attitude led TI's top

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management to believe that it didn't really need experienced computer engineers from the outside, even though the company had never before made a personal computer.

The strategy developed by the consumer-products group was to build three computers using the 9900 microprocessor, aiming each at a different segment of the market. At the high end would be a small business computer that would retail for about $7,000; in the middle, a sophisticated scientific calculator that would cost about $1,000; and at the low end, the so-called home computer, which would cost between $300 and $400. While the first two computers would be competing against other companies' products, the home computer was an original idea.

At the time, a few companies were selling machines called personal computers — notably Apple and the Tandy Corporation of Fort Worth, Texas — but they weren't what we've come to think of as home computers. They were expensive, geared for a select market: businessmen who wanted to work at home and hobbyists who liked to fiddle with computers.

The TI machine, on the other hand, was going to be the first computer designed for Everyman. Did Everyman need — or even want — a computer in his home? That was impossible to say, because no such product existed and most Americans had no feel for how a computer might be useful. Yet TI was unperturbed by the prospect of trying to create a market. The feeling at TI was that it had a knack for consumer electronics and that its knack would come to the fore again, with the home computer. TI would put out a computer that was just powerful enough to entice the average person to take the plunge — no word processing, but plenty of educational programs for the kids — yet inexpensive enough that the plunge wouldn't break the bank. On the basis of price alone, TI thought, the machine would sell. Convincing people that they needed it could come later.

It wasn't long before events began to conspire against the consumer division's carefully laid plans. First, the man who had devised the three-computer strategy quit in frustration over the problems he faced in Lubbock — particularly the inability to hire the outside engineers he thought he needed. Then his chief supporter back in the Dallas headquarters took an overseas assignment. Other division heads complained to top management that the business computer and the calculator didn't belong in the consumer group, and they managed to have those two computers taken away from consumer. Both projects were eventually killed.

So the three-computer strategy was now a one-computer strategy, and that computer was at the low-profit end of an unknown market. To make matters even more complicated, there was another management shuffle in 1978, and the man put in charge of developing the home computer was an engineer whose previous job had been to design the expensive business computer. He didn't see the home computer in quite the same way that his predecessor had, and by the time he finished tinkering with the design, it was no longer a $400 machine but a $1,150 machine. Then, although TI had announced that the computer would be ready by the middle of 1979, the engineers didn't shake all the bugs out of the system until the first few months of 1980, and thus missed an opportunity to cash in on the 1979 Christmas season. And finally, when the new 99/4 hit the computer stores, it turned out that the average American had no idea what to do with a home computer and wasn't interested in paying $1,150 for one.

To the great dismay of everyone at Texas Instruments, the 99/4, four years and $10 million or so in the making, was a bomb.

The keyboard is what computer people most remember about the TI 99/4 home computer. The keyboard somehow became the symbol for everything that was wrong with the machine. It looked like an elongated calculator keyboard, with stubby little keys that popped through the plastic casing. TI had chosen a calculator keyboard because most of the engineers who developed the 99/4 had cut their teeth on calculators. But a short time before the 99/4 came out, another company had put a calculator keyboard on a personal computer. The keyboard was widely criticized, and out of that experience grew a belief that calculator keyboards wouldn't cut it. Texas Instruments, so intent on putting out its own product, scarcely noticed.

It should have, for something significant was afoot. Five years earlier, when Texas Instruments first decided to get into the consumer end of the computer business, the field was wide open. There weren't any real industry standards because there weren't enough machines being made. The companies that did well were simply the ones there first with the technology. By 1980 the computer industry was entering a watershed period — a period when being there first no longer ensured success. The moment was about to arrive when the importance of creating a product would be superseded by the importance of selling one. It is a moment every new industry faces eventually.

In the computer business this watershed meant that from now on, you ignored the vagaries of the marketplace at your own peril. Advancing the technology was no longer enough; you had to be sure that you were advancing it in the direction that the market was heading. Timing became critical; if you didn't have the right product at the right moment, it would likely fail.

Most of all, you had to be able to explain what it was about your computer that set it apart from the pack. Doing that took the skills not of engineers but of marketing people, and companies that had always depended on feats of engineering for success were bound to have trouble.

So the lesson of the calculator keyboard was not that it was an engineering mistake — at bottom, it really didn't matter what kind of keyboard you used — but that it was a ***marketing*** mistake. And the same applied to other facets of the machine. Using the 9900 microprocessor, for instance, was good for the Texas Instruments division that made the chip, but it caused far more problems than it was worth.

Because TI's chip division had to make a profit despite the low demand, the cost to the consumer division was very high — about $20 a unit compared to about $4 for most of the popular 8-bit microprocessors. Because it had been designed for industrial uses, it did not adapt well to a consumer system; the advantage of having a 16-bit microprocessor was negated by the circuitous way programs had to be written for it. And because nobody else in the industry was using it, independent software companies, the third-party vendors, as they're called, had no incentive to write programs for it.

Not that Texas Instruments wanted third-party software, which was yet another way the company was bucking the system. Software is the most profitable part of the computer business — a $40 program cartridge costs Texas Instruments about $6 to produce. But one of the new rules of the marketplace was that software companies could write programs for any computer — and then pocket *all* the profit themselves. TI hated the thought of sharing that kind of lucrative profit with outsiders.

So instead of making it easy for software companies to market programs for the 99/4, TI went out of its way to make things difficult, even making adjustments in the machine that kept outsiders from writing software for it. The result was that while there were hundreds of programs for most personal computers, there were only a handful for the TI machine.

By fall 1980, with Texas Instruments selling fewer than 1,000 computers a month, the people in the consumer-products group had come to the not-unexpected conclusion that it was time to go back to the drawing board. Peter Bonfield, then the head of the home-computer division, felt that the most critical flaws in the 99/4 were its price and its 9900 microprocessor, so he asked his engineers to design a computer that used a different microprocessor and that cut the

cost in half.

The chip they chose was the Z-80, first manufactured by the Zilog Corporation, one of the most widely used 8-bit microprocessors. The design for the computer they came up with was so good that they thought they might get TI to bend its rules a little. But Bonfield had to get the new design past Bucy and Shepherd — and past an engineer named Don Bynum.

Bynum was 36 years old and a newcomer at TI. He stood out from the gray mass of TI engineers because he had a little more talent than most of them and a little more drive and a little more flair. But what he had most of all was compelling personal presence. Bynum was a great one for rallying the troops. When things were going badly, he liked to give what he called his General Patton speeches, and the people under him would stay later and work harder until everything was right again.

When Bonfield's new computer design began making the rounds at TI's Dallas headquarters, Bynum was assigned to the company's Corporate Engineering Center, where research-and-development proposals were evaluated. This position allowed him not only to see the design but also to take sides. He sided against Bonfield and quickly became the leading in-house critic of the new computer. His entire argument was based on the idea that the 9900 microprocessor should not be abandoned, precisely what Bucy and Shepherd wanted to hear, of course. To prove his point, he put together his own redesign of the 99/4, called the Ranger. The Ranger did not solve the price problem or the keyboard problem or the software problem, but it did address another nagging problem, the haphazard way the peripherals fit together with the computer.

When Shepherd and Bucy shot down the Z-80 design, they also shipped Peter Bonfield off to the calculator division (he left TI soon thereafter) and replaced him with Don Bynum. In November 1980 Bynum moved to Lubbock to run the home-computer division, and the first thing he did was confiscate all the prototypes of the Z-80 computer. The second thing he did was trot out his Ranger designs. And the third thing he did was realize that the Ranger was a mistake.

A couple of months after he arrived, the Ranger was as dead as the Z-80 computer, for Bynum had seen designs for yet another computer, and he had fallen in love.

The new design had been slapped together by a small group of engineers. They were frustrated with the way things were going, but they had become convinced that the Z-80 design would not be approved. This, too, was consistent with the TI culture; if you were dissatisfied, you *did* something. And if your superior liked it, there was a good chance that it would be adopted.

The engineers' new design kept the 9900 microprocessor (there wasn't any getting around that) and the main circuitry of the machine, but changed the way the computer looked. Now the computer had a typewriter keyboard. The keyboard had also been separated from the screen so that the screen became optional. (The keyboard could be attached to a television set.) They also drew up proposals for cutting down the number of chips needed to run the computer, which had the effect of dramatically cutting costs.

When Bynum came on board, he became a champion of the new design, and it breezed past the corporate hierarchy in Dallas. By summer 1981, after months of working up prototypes, getting the kinks out of the system, and passing the various radiation tests mandated by the Federal Communications Commission, the 99/4A was ready. The basic cost of the computer to the retailer was $340 — and the price to the consumer, without peripherals, was going to be $550. Don Bynum had done his job. But would it sell?

The hard part about selling a home computer is that, unlike a personal computer, it has no immediately recognizable purpose. The Texas Instruments 99/4A, four or five times less expensive than an average small business computer, was also considerably less powerful. It had 16K of memory, for instance, whereas most small business computers had 64K of memory. That meant that you could play computer games on the 99/4A, or run some educational programs, or learn, in a limited way, the computer language. And you might be able to do a few basic tasks, like balance your checkbook. But to do anything more substantial, you had to invest several thousand dollars in peripherals. Was a home computer an appliance or was it a toy? Was it the beginning of the electronic future or was it the hula hoop of the 1980s? Why *did* you need one anyway?

The man whose job it was to answer that question at TI was William J. Turner, 36, and he was that rarest of birds at Texas Instruments, an outsider. He had been hired away from Digital Equipment Corporation in May 1980 and had been named marketing manager for TI's consumer-products group. Although he had a degree in mathematics, he had gotten his job precisely because he wasn't an engineer. Turner had spent his career marketing computers.

He brought to the home-computer division something it hadn't had before: a sales mentality. Bill Turner was gung ho about whatever product he was selling, upbeat and enthusiastic no matter what the actual state of affairs. He was great with numbers and projections. In meetings he always had a chart that proved beyond all doubt that the home computer was about to turn the corner. His optimism had a lot to do with the early success of the 99/4A, and with its ultimate failure.

He came to his job with two crucial theories. First, he believed that you couldn't sell a home computer in a computer store. Computer stores were meant for people who already knew something about computers or who were serious enough about them to spend several thousand dollars on one.

Turner wanted to get the 99/4A placed in the kind of retail stores that already carried the company's pocket calculator, stores like J.C. Penney and Sears and Montgomery Ward. From the day he walked in the door, Turner spent much of his time building up this retail network, and he was good at it. Every month he would report new successes. Toys R Us had signed up; K mart had signed up; even 7-Eleven was on the verge of signing up before the roof fell in at TI.

Turner's second theory was that the price of the 99/4A had to be a lot lower. If the price was low enough, it wouldn't matter that the home computer was more toy than tool. People would buy it on a lark. Bill Turner wanted to sell price, and that became the cornerstone of his marketing strategy.

So in the months after the 99/4A was introduced, Turner began bringing the list price of the 99/4A down, from $550 to $450 to $375. He did this partly by making what seemed to be outrageous volume projections and then hustling up new retail outlets to absorb that volume.

He also pushed Bynum's engineers to find ways to lower the cost of the machine, by simplifying the design, eliminating chips, and so on. That way the profit margin on each computer remained steady — 40% — while the price went down.

With each new round of cutting costs, the engineers became increasingly unhappy with Turner, for they felt he was pushing them to do too much, too fast. But no one could argue with the results. TI had once produced fewer than 8,000 99/4s a month; it was now producing that many 99/4As in a good week. That wasn't enough for the consumer-products group, with its large overhead and R&D budget, to turn a profit, but it was more than enough to make people believe Turner when he pulled out his latest chart and said the 99/4A was about to take off.

By then, however, Texas Instruments was not the only company in the home-computer business. Atari, the video-game maker, had had a computer out for some time that was under $1,000 — the Atari 400. Several toy companies, particularly Mattel and Coleco, were trying to get out of video-game consoles (which wouldn't

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have a chance if home computers really hit) and into home computers.

Timex had a home computer in development, which it hoped would establish an entirely new market, the under-$100 computer. And then there was Commodore. Nine months after TI put the 99/4A on America's retail shelves, the Commodore Corporation introduced its first home computer. It was called the VIC 20, and it came on the market at $299.

Talk to anyone who ever worked on the 99/4A, and you'll get the same story. Commodore's VIC 20 couldn't compare with the 99/4A. It was true. While the 99/4A didn't measure up to the more expensive small business computers, it looked spectacular next to the VIC 20.

The VIC 20 had a measly 4K of memory, while the 99/4A had the 16-bit 9900. The VIC 20 had only about 40 chips in its entire system; the 99/A had 60. There was no question that the TI computer was a far more powerful, far more sophisticated system.

The 99/4A's advantages, however, didn't necessarily translate into sales. The computer business didn't work that way anymore and hadn't for some time — and nobody understood that better than Jack Tramiel, the president of Commodore.

Although he has recently resigned from his position, Tramiel remains a near-mythic figure in the computer business. He has a reputation as a tough, driven entrepreneur who, through shrewd dealing and brilliant marketing, single-handedly built Commodore into a major force in the computer business.

When Tramiel set out to conquer the home-computer market, he knew as well as anyone that the VIC 20 was not a match for the TI 99/4A on the basis of performance. He also knew that the 99/4A was no match for the VIC 20 on the basis of price.

Once before, Commodore had put out a product in a market where its chief competitor was TI: a line of digital watches. TI started a price war and drove Commodore out of the market. Tramiel was not about to let that happen again. No matter how low the 99/4A went in price, Tramiel's machine could go lower. It simply cost less to build.

In retrospect, the great mistake Turner made was in creating a marketing stategy for the 99/4A that lived and died on price alone. He could have promoted the 99/4A's superiority to the VIC 20 and justified a higher price on that basis. He could have tried harder to answer the question of why consumers needed to buy his home computer.

It is not just in retrospect that this is obvious; it should have been clear at the time. As soon as the VIC 20 came on the market, some Texas Instruments engineers took it apart and analyzed its insides. They poked fun at what they found, but it was apparent that it was cheaper to make. The VIC 20's cost advantage was not a deep, dark secret.

Yet Turner refused to change strategies. He won't say why (Turner wouldn't be interviewed for this story), but people who worked under him say that it had to do with ambition — both Turner's and Texas Instruments'. Turner wanted the 99/4A to dominate the market, and that was the kind of ambition that was fostered at Texas Instruments. The only way to do that was to go head to head with his toughest competitor, Commodore. Turner wanted a price war with the VIC 20.

He could not, however, start a price war by himself. Although chief operating officer Bucy and chief executive officer Shepherd gave wide latitude to successful division heads, Turner was not yet a division head. He was on the same level as engineer Bynum, who ran the home-computer division. Still answerable to a chain of command, in the tug-of-war between his desire and the desires of Bynum's engineers, Turner lost as many as he won. The engineers would surely go to the mat if he tried to drop the price of the 99/4A to match that of the VIC 20.

So, between April and August 1982, Turner had to be satisfied with fighting the war on other fronts.

William J. Turner, head of marketing for Texas Instrument's home-computer division, wanted a price war between TI's 99/4A and Commodore's Vic 20. But influential TI engineers still believed that the company didn't have to lower the price; that consumers would buy the 99/4A because it was more powerful and more sophisticated than the Vic 20.

TI's corporate culture had always held that the best way to sell a product was to build a good product. So between April and August 1982, Turner had to be satisfied with fighting the war on other fronts. He hired Bill Cosby to be the television spokesman for the Texas Instruments home computer and paid him $1 million a year to do TV ads for the 99/4A.

But Commodore's ads for the Vic 20 were more clever and were aimed at kids rather than parents. Turner continued to add to the network of retailers selling the 99/4A, but Commodore was with him at every step and quite often a step ahead of him.

And why not? Most customers didn't know the difference between eight bits and 16 bits. Neither did most of the people working in the stores. Texas Instruments was doing nothing to explain the difference. All the customer knew was that two computers were sitting side by side on a shelf and one, the 99/4A, cost $300 and the other, the Vic 20, less than $250.

In August 1982, Turner got a major promotion — and a chance to take matters into his own hands. He was named president of the consumer-products group. Engineer Don Bynum, who opposed the price war when he ran the home-computer division, was also promoted, but Turner and Bynum were no longer equals. Turner was the boss.

From previous discussions with the engineers, Turner knew that it would take at least a year to design a new computer that would undercut the Vic 20. He didn't want to wait that long, so he decided to go after the Vic 20 with the product he already had. If the volume could keep finding cost reductions . . . if the engineers could keep finding cost reductions . . . if everything broke right . . . maybe they could pull it off. Maybe it would be a repeat of the Commodore-TI battle over digital watches. On September 1, 1982, at a time when the 99/4A was selling for about $300 and the Vic 20 for $250, Texas Instruments announced a rebate for the computer that effectively lowered the price to $199. This time there was no cost cutting by the engineers to match the price cut. The profit margin on the 99/4A was halved, but Turner wasn't worried about that. That same day Commodore dropped the price of its machine $40 to match TI's. The price war was on.

For the next four months, Turner's price strategy worked like a charm. Fall and winter 1982 were Turner's time of triumph, for in those months the 99/4A became the machine TI had always wanted it to be, a computer the average American would buy. Almost as soon as the price cut was announced, sales rocketed. Turner was suddenly a corporate superstar at TI, the marketing genius, the outsider who had shown the engineers how to sell a computer. He had the numbers to back him up. The assembly lines were churning out 150,000 computers a month, and because of that enormous volume, the personal-computer division turned out its first sustained profits. The retail network now had some 12,000 stores; the 99/4A was outselling the Vic 20 three to one; and a $20 million business had become, overnight, a $200 million business.

By the end of 1982, the 99/4A was the top home computer in the United States, and the entire staff was "on a high," as one engineer remembers it. They were heroes; when home-computer people went to Dallas for meetings, TI colleagues would come up to them and tell them how great it was that the 99/4A was such a success. When 1982 was over, the home-computer division had, in the words of one former employee, "zero retail inventory," which is to say, you couldn't find a 99/4A anywhere in the country. They were sold out.

With things going so well for the 99/4A, Turner and the consumer-products group made their next big mistake. They

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got greedy. Timex had a dinky computer on the market that cost about $100; it wasn't much, but it was selling, and Turner decided to go after it. He had Bynum pull together some engineers, and they undertook a crash program to develop a competitive product to be called the 99/2. Several other computers were competing in the $500-to-$1,000 price range, and TI had long been developing a computer for that market: the 99/8, known by the code name "Armadillo." (Commodore was developing a computer for the same market, which became the enormously successful Commodore 64.) It was partly good marketing strategy to come in behind the original computer with a more advanced computer like the 99/8; that's the way markets evolved. But who cared if Timex was selling some $100 computer that couldn't do much? Was that really the direction in which the market was going? It seemed that Turner and Texas Instruments simply wanted it all.

That same attitude was evident in TI's stance toward third-party software vendors. Before the price war, Texas Instruments had finally modified its policy toward independent software writers, largely at the urging of Don Bynum. It was obvious that TI's refusal to allow independents to write programs for the 99/4A was hurting the company. Everybody else was doing the opposite. Even IBM, a company every bit as secretive and closed as TI, had "opened the architecture" — that is, allowed software writers to see how the machine was built — before it came on the market. Hundreds of people were writing software for Apple computers, and the huge array of software generated by these third-party vendors had become a key sales asset. The Vic 20 also had open architecture, and the result was that it had many more games, for instance, than the 99/4A.

Texas Instruments could never bring itself to open the architecture, but in summer 1982, it did give its tacit blessing to several former TI engineers who started their own software companies. Two companies were formed with the purpose of writing software for the 99/4A, and one of them had a contract with Texas Instruments ensuring that it wouldn't have to worry about a patent-infringement suit from TI. When sales of the 99/4A began to boom, the clamps went back on. TI took out ads in trade publications that threatened lawsuits against any company that wrote software for the 99/4A without being licensed by TI. Any company that wanted to write for the 99/4A had to do it on TI's terms, meaning that TI got to keep all but 10 percent of the profits.

In the software industry, much anger and resentment greeted the tougher policy, and a consensus developed that Texas Instruments had gone mad in its quest for profits. The truth was that TI needed those software profits over the long haul. With the price war on, the company wasn't making very much on the computer itself, and it was conceivable that if the price continued to drop there would be no profit on the machine at all. But for now Turner wasn't worried, and neither were his superiors.

Early in January 1983, Turner, Bynum, and some other people from the consumer-products group went to Las Vegas for the semiannual Consumer Electronics Show. The CES is to home computers what the Paris Air Show is to airplanes. It is a place to do a little business, but more than that, it is a place to see what the competition has been up to and to scope out new trends, trade war stories, and strut your company's stuff.

TI's extraordinary fall and winter had brought forth from Bill Turner optimistic forecasts for the future. According to his projections, 1983 would be the year of the home computer. Nearly seven million would be sold that year, he predicted, more than triple the two million sold in 1982. And of that seven million, he estimated — promised, actually — that three million would be sold by Texas Instruments (whereas about 500,000 had been sold in 1982). Most analysts thought those figures were way too high; they were predicting sales in the area of four million. But Turner was undeterred. The home-computer revolution had begun, he said, and TI was about to take over the market. The analysts, on the other hand, said that with the price so low and the machines so limited, most people thought of the home computer as a toy, which meant that sales would always peak in the months before Christmas. To them, that timing had as much to do with TI's success in late 1982 as the price war did. Turner, in contrast, was predicting that every month from now on was going to be about twice as good as December 1982 — the best month ever for the 99/4A. With chief operating officer J. Fred Bucy and chief executive officer Mark Shepherd in tow, he was going full-steam ahead.

The Consumer Electronics Show in January seemed only to confirm Turner's inflated sense of the market. For the week of the show, the TI booth was overrun with people. Everybody wanted a piece of the 99/4A. Bill Turner got enough orders at the show from retailers that when he came back to Texas he told Bucy and Shepherd that the first six months of 1983 were "already in the bag."

On the last day of the show, the TI crew went out on the town and wound up in a Las Vegas bar, where they started drinking tequila. They talked about the show and the products and how it looked like there was nothing on the horizon that might stop the 99/4A or the 99/8 and the 99/2 when they were ready. "Some guy from Apple told me they've sold 200,000 computers in schools," one man said. "I told him we put out more than that in a month." Everybody roared. The drinking produced an exaggerated sense of pride and accomplishment and even invincibility, and late that night, as they staggered from the bar, Don Bynum jumped on top of his rental car, raised his arms to the heavens, and gave one of his General Patton speeches. At that moment, he was king of the hill.

That night's jubilation was the pride that went before the fall, for the fall came very, very quickly. In January, Commodore cut the price of the Vic 20 to $125; a few weeks later TI was forced to follow suit. The inevitable had happened: the 99/4A was no longer making a profit; it was merely breaking even. But there were plenty of orders from retailers, much of it on backlog since Christmas, so Turner kept pushing the computers out. In February, a serious snag developed, the sort of thing that happens all the time to computer makers. TI discovered that a transformer bought from an outside company was faulty. Even though the transformer had passed the U.S. government's safety tests, it failed a Canadian test, and though TI didn't have to, it decided to replace the part. It ordered stores to stop selling the 99/4A and then sent TI employees out to retail outlets across the country to fix the faulty part. At the company's annual meeting in April, Bucy announced that the problem had cost $50 million and had erased the profit that the computer had made the previous quarter.

Still, for each of the first three months of 1983, orders were up, largely because Turner kept expanding the retail network. At the annual meeting, Bucy announced proudly that Texas Instruments had shipped out its millionth home computer. But shipping was not the same as selling. By finding more and more stores that would carry the computer, Turner could keep production high without worrying about what was happening once the computer got into the stores. TI's obsession with expanding the retail network had become a shell game, a delusion, for it left out the one thing that truly mattered. Were people actually buying the computers? The answer, it soon became clear, was no.

On April 4, Commodore cut the price of the Vic 20 to $99, thus putting Turner in an untenable position. It cost more than $99 to manufacture the 99/4A. He stalled for time, announcing that TI would offer a new rebate on the home computer by June. But it wasn't good enough. Now the Vic 20 was back where it had been before the price war began — sitting next to the 99/4A on retail shelves, costing much less. At the same time, with the Vic 20 so inexpensive, the market for the Timex product dried up completely.

Texas Instruments quietly canceled

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the 99/2, the machine that was supposed to compete with Timex, before it ever came out. People in the consumer-products group were beginning to see the writing on the wall. At the end of March, Don Bynum was reassigned to TI's Dallas headquarters. Running TI's $200 million computer business had become a manager's job, and Bynum thought of himself as an engineer. Also, the pressures, particularly the transformer problem, had taken a toll on his health, and his doctor told him he needed to find another job. Before he left Lubbock, Bynum sat down one last time with Bill Turner, and they went over the numbers. Turner hadn't changed a bit. Yes, things had been tough, he told Bynum, but it was still going to be a great year. The transformer problem was behind them now, the retail base was still strong. Why, just that month Turner had added the Sears stores to the network. With just a few readjustments, they could still sell three million computers. He was just as gung ho, and as persuasive, as he had ever been. Bynum left that meeting half believing that Turner could pull it off.

But of course he couldn't, not with a machine that could never make a profit even it it did sell. In late April, the numbers caught up with him. Because the consumer-products group was adhering to Turner's forecast, the TI assembly lines kept pushing out computers as fast as they could. But now computers began coming back to TI. Just because a retailer had a machine on the shelves didn't mean he had actually bought it. He had the right to return it. "Sales" that had been posted by Turner were revised and lowered. It wasn't going to be December all year round. Turner's optimistic projections were crashing down around him.

Bucy and Shepherd received the stunning news that despite everything they'd been told, all was not well with the home-computer division. That they hadn't known before was not so surprising, given the company's culture. It left the winners alone, but it didn't spend much time coddling losers, and that's what Bill Turner had become at TI. They brought in another manager, Jerry Junkins, to run the show, and Turner left the company a few months later.

By the beginning of May, it was back to the old ways. Junkins was a longtime TI employee and a highly regarded manager, but he came from the company's government sector and had no consumer experience. Nonetheless, his mission was to stem the flow of red ink as best he could. In June, in an effort to get the computer moving again, he matched the Vic 20's $99 price. He revised the projections and began shutting down assembly lines and laying off workers. Plans were drawn to redesign the computer and get the cost down more so it could be profitable again.

But nothing helped. Home computer sales of both the Vic 20 and the 99/4A were sluggish, although for Commodore that wasn't so bad. It had begun phasing out the Vic 20 by then, and its new product, a more expensive, more powerful Commodore 64, was entering the marketplace to take up where the Vic 20 had left off.

Junkins wasn't the only new face in the consumer-products group. In the management reshuffle that took place, half a dozen new people were brought in, and J. Fred Bucy himself took charge of the home-computer operation. He began making regular trips to Lubbock, asking pointed questions of the engineers. "We've made a mistake," he would say in meetings, "and we've got 30 days to turn it around." Bucy scrapped Bill Cosby, and instead instituted a series of ads that stressed the educational value of a home computer. After all, that's how Commodore was selling its 64.

But there was really nothing that could be done quickly. The mistakes were too big and they had been allowed to go on too long. By the second quarter of 1983, anyone who followed American business knew the TI home computer was in danger. It was then that Shepherd and Bucy announced that the company had lost $119 million that quarter because of the home computer.

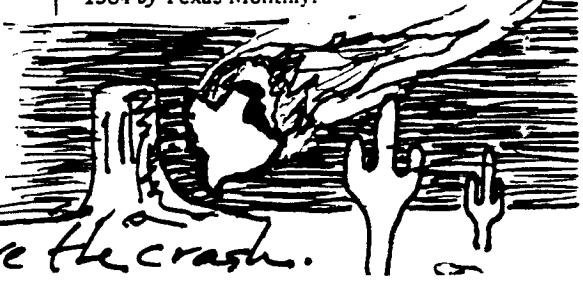
There was one final hope: the 99/8, TI's higher-priced, higher-performance computer. If the 99/8 did well, it could keep the home-computer division in business as the 99/4A's were phased out. But at the 1983 summer electronics show, even that hope was dashed. TI brought the 99/8 to the show, ostensibly to unveil it, but kept it behind a locked door for the entire show. It was embarrassing; some of the trade papers even published photographs of the door. No one at Texas Instruments would say why, but TI didn't seem to think the machine would stack up against the rash of new computers aimed at that market. Coleco had announced Adam, a $600 home computer that included peripherals like disk drives and a printer. The price of the Commodore 64 was coming down. Apple was supposedly working on a home computer. IBM was getting ready to enter the home-computer market with a machine called the PCjr. After the show, there were meetings to discuss the future of the 99/8, and at the last of them, Fred Bucy got in front of everyone and said, "I don't think this product can make any money. Does anyone disagree?" No one did. The 99/8 was dead.

Pulling the plug on the home computer three months later was an act of mercy — it put the home-computer division out of its misery. Could the situation have been turned around eventually? Possibly. But it would have taken new products and new approaches in the marketplace. And most of all, it would have taken time, which TI didn't think it could afford. The stock was dropping because analysts had become so soured on the 99/4A. The losses were continuing to mount; in the third quarter TI took a $300 million bath. When Bucy and Shepherd looked into the tunnel, they could see no light.

The collapse of the 99/4A did not take Texas Instruments completely out of the computer business. In early 1983, the data-systems group, in Austin, put out a TI professional computer that sells for close to $3,000, and a few months ago the same division introduced a portable business computer for about the same price. But the TI Professional is competing in a market that in the past year has come to be dominated by the IBM Personal Computer, and nothing TI does is going to change that. The IBM PC has become the de facto standard in the industry, and the lion's share of the market from now on will always belong to IBM and to competitors that are "IBM compatible." The TI Professional is not IBM compatible.

What the future holds for the TI Professional depends a lot on what aspirations TI has for the machine. If the company is content to cede the marketplace to IBM, if it is willing to sell 50,000 computers a year while IBM sells 500,000, then the TI Professional will probably be a success, albeit a limited one. But if TI decides that it has to go head to head with IBM, then the TI Professional, like the home computer before it, is a disaster waiting to happen.

So far, Texas Instruments seems to have learned at least some lessons from its disaster. When the Professional was first envisioned, the consumer-products group, backed by Bucy, made a strong play for having the machine produced in Lubbock. But the consumer group lost that battle. The machine eventually developed by the data-systems group contains not a 9900 microprocessor but a microprocessor made by Intel. After the experience of the home computer, the 9900 was never seriously considered. And last November, at the Las Vegas electronics show, the several dozen engineers and marketing people in TI's large booth all wore buttons that showed they had learned another lesson from the 99/4A. The buttons read, "Third-Party Vendors Love TI."



Look ma, no drive!

The Solid-state Disk Emulator is a device that uses memory chips in place of a disk drive. Being able to store and retrieve information electronically, it is considerably faster than the mechanical/magnetic disk drive system.

This method of data storage is the logical successor to the disk drive. At the present state of the art it has quite a few pluses and one minus. The pluses are, saves wear and tear on your disk drive if you are working on material that requires frequent input from a disk. Just copy the disk contents into the disk emulator and call it up as needed on the task at hand. This saves wear and tear on your mechanical drives. Using any disk-intensive software where additional data must be called up or stored quickly without the time lag found with the use of the disk drive. Telecommunications is another use that saves money in both phone charges and online charges by down loading information from a large data bank such as the "Source" or "Compuserve". It has one draw back and that is because it is an electronic device, the information in memory is lost when the system is powered down. I feel that this is a temporary problem that will soon be eliminated either with batteries or external power supply. This applies to the unit that I am using. During this past summer, I received notice from Foundation Computing, that the solid-state disk emulator was now available for the 128K memory card. I had originally bought this unit which also contains the normal 48K extended memory used in the peripheral expansion box. This extra memory is available in bank switched areas of two 48K sections and one 24K section, which can be utilized as temporary memory storage known as DSKX.1, DSKX.2, and DSKX.3. At any time three files may be worked with using either TI Writer, Multiplan or Terminal Emulator. Then transferred to disk when the work is completed.

For those who already own the Foundation 128K extended memory this addition costs $29.95. It was necessary to send the memory card back for installation of the additional chips, which did not permit use of TI Writer during this period. During nice Summer weather I did not miss this part of computing too much, but I sure was glad to get it back in good condition.

More on this subject as I become more experienced in it's use.

Incidently, I tried an experiment in which I saved this article both to DSK1. and DSKX. It took 11 seconds for the disk drive and less than a second to the electronic DSKX.

>Bob Kunkle

MORE OK: La Fara replies, Caine is sorry, I'm out of space.

Tracy Caine called right after he read our last newsletter. He didn't have much to say, save that he was sorry that we were without a DS drive, and even sorrier that we sent them on to Atlanta. Charles LaFara, IUG's pres wrote a reply that said he would reply if asked. (Noteworthy: Data Stream, [newsletter of Rock 99 Computer Club, c/o T Sewall N 2425 Chapel Dr, Whitewater, WI 53190] suggests the IUG grosses $2.5*10^6 !!! LaFara just says that overhead is over $5000/week. To be continued.....

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52302

"Baggins! We hates it, we hates it, we hates it for ever!"
Bilbo turns to Golem and replies: "I don't care for PASCAL much, either".