TI*MES

Issue 54
Autumn 1996

Contents

Page 3	**Editorial**	
	Welcome to issue 54	
Page 4	**Rambles**	
	Puzzles, news and views from Stephen Shaw	
Page 7	**From The Chairman's Chair**	
	Musings from Trevor and the second part of the Line By Line Assembler tutorial	
Page 12	**News And Reviews**	
	From the man with The Blues	
Page 16	**The Orphan Chronicles**	
	The first four chapters of Ron Albright's excellent Orphan Chronicles book	
Page 42	**Listings**	
	Lots of listings for you to type in	
Page 48	**The Back Page**	
	More nonsense from the world of computers?	

Magazine scanned 2022 by Stephen Shaw

All contributions for issue 55 must be submitted by December 1st 1996
You can use your modem to call the MOBB Bulletin Board on 01623 491282

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Editorial

Hello again! Another quarter, another magazine. Hopefully this should reach you before the end of November (as I type this fireworks are exploding outside and bangers are being inserted into car exhausts...) Again I have to apologise for the late arrival of the magazine and again I have a whole array of excuses lined up. In truth, the best bet is to read the editorial from the last issues and stick it to the top of this - the reasons are the same!

There have been a few additional problems this month - many of you have made use of the bulletin board to contribute and, as though the great god of bad luck Murphy (he of the law) was paying us special attention, the bulletin board has died a horrible death. It seems the disk controller card has finally given up the ghost (although the contents of the disk itself are safe) leaving all the submissions in purgatory.

This means I owe a very big apology to anyone who responded to my plea for material in the last issue and expected to see it in this issue. I owe a special apology to John Murphy of Dortig who has uploaded a lot of submissions and who I know will be very disappointed not to see them in TI*MES. Sorry, John.

However, there is a silver lining to the cloud - I am told by Trevor that there is enough material on the board to actually produce an entire magazine from which means that as soon as the board's data is resurrected (the board itself is already running using a PC and a public domain BBS called WildCat) I can download it and put the magazine together in double-quick time. Which means, if all goes to plan, the Christmas issue will be with you by Christmas 1996, rather than 1997 (going by past form.)

I'm also sad to announce that the Christmas issue will be my last as editor. A recent change of job (same company, different position) has meant more work and the loss of the weekends I used to use to deal with TI*MES related information. In addition, my wife and I are expecting our first child; the arrival of which clashes with the production of the spring issue. I'll be more careful next time! But this basically means from having little time, I'll have no time whatsoever for anything but article writing.

So, if anyone fancies the role of editor, they should contact Trevor and let him know. I'll carry on after the Christmas issue as acting editor until a ~~fool~~ volunteer can be found (only kidding!)

So, what else is there to talk about? It is certainly a very exciting time to be involved in the TI scheme - it looks as though the SCSI card produced by Western Horizons may at last be a practical solution to the ever-present storage problem.

The July issue of Micropendium contained a review of the new Geneve 9640 being manufactured under license by Cecure (I am trying to get permission from the Micropendium people to reproduce the article)

TI Web sites are popping up everywhere - if you have a access to a web browser (or are brave enough to use the character based interface the TI supports) then you can download a massive variety of software and information completely free of charge (aside from phone and provider charges.) Of course, for those without access to an Internet-enabled PC, the group's BBS is also a good alternative.

The BBS has had some exciting developments - Trevor is currently building a PC which will hopefully allow the BBS to run 24 hours a day, 7 days a week with access to a massive hard disk of data and even a CD-ROM (which can hold 650 ***megabytes*** of TI software!)

So, 1997 looks set to be the best yet for the TI in terms of hardware and software available and useable by the ordinary user. Hold tight, it could be a wild ride...

Richard

Rambles

Stephen Shaw

Hello again!

Very short this time round I regret. Following the unfortunately late dispatch of last TI*MES, the issue arrived as I was setting off on holiday and quoted a 'required by' date before I got back from holiday!

This is therefore written very quickly upon my return, in the hope it gets in on time.

I have a number of disks to add to the library, thanks to the donation from central funds reported in the last issue. Here are the latest adds to select from - I anticipate more for the next issue too.

Disk Library Additions

All disks one pound to copy one side SSSD, plus one pound per order, if you send blank disks or add 50p per disk if you wish me to supply.

Merle Vogt Mini Mem

A set of text articles plus source and object code, intended to help you to program using the mini memory module and the line by line assembler. *TWO DISKS* Please note that this disk set is not written for the assembly novice.

Merle Vogt Loaders

A set of TEXT files covering the three different assembly loaders that TI supplied us with (EA,MM,XB) with extra text on using the EA5 image loader. Also a short article on use of 3.5 inch drives. *TWO DISKS* Please note these articles are not written for novice assembly programmers but rather to cover in more detail what has largely NOT been published elsewhere.

MERLE VOGT XB...A single disk that covers that vexatious question of programming in assembly in a form that XB can load and use and in particular the special ` hybrid` form of program such as the Funlweb 'Load` program. Quite a technical read and not for novices.

- Please note that the Vogt articles are NOT repeated in the disks above—

Term80 Demo

As briefly mentioned in the last issue, but this is NOT the full working version, you have to pay for that. *TWO DISKS* Notable omissions seem to be the lack of FILE transfer, macros, auto log on, device drivers. Registration is Canadian $20. This demo version will allow you to see at low cost whether you can copy with an 80 character screen on your TV set. This is Vn3.1.4 and is by Jeffrey Brown

Tunnels Of Doom Data Disk Three

Requires Tunnels of Doom module. Files are Dune, Comp/Nit, Dark/Twr, Garfield, Gnom/Rng and STAR?TRK.

Jimmy Dowell's Board Games

Backgammon, Can't Quit (a 2 player game), Fox Hunt, Nothing but Trouble (LUDO to me) and Peg Jump.

Virus Attack

By Vern L Jensen. As mentioned last issue NOT playable on a mono monitor or a black and white TV set.

Bill Gaskill TI Based Articles

8 plus EFONT which allows you to have proper lower case in your XB progs.

ATLANTA 99 USERS GROUP DISK OF THE MONTH 6/95 *TWO DISKS* (COULD FIT ON ONE DISK WITHOUT GENETICS AND PICTURES)

Disk includes Archiver 3.04 Giffy Picture Loader 0.7, which allows you to view GIF and P pictures, 2 player mini golf (Compugolf requires colour), Maple Leaf rag music, Bass fishing, Garden Tips, Genetics (archived and required gram kracker device), Plant Library. The 'front end' is also usable - MS DOS by Miti Ware, which is as the name implies a disk operating system - really a menu system.

Load Master 2.1

By Mickey Condrowski. A front end program largely XB which allows you to catalogue a disk, read text files, run a BASIC program and print disk labels and jackets.

Reminders By Bill Gaskill

Used 19card file (on computer) for a data based retrieval system. Can display/print a monthly calendar. Please note the calendar ceases in the year 2000!

Cartridges By Bill Gaskill

THREE DISKS Text articles by Bill on TI modules, released and unreleased. An historic archive of info. Also some filler 'Byte Bits' material of general archival interest.

Puzzle Five

Find the factorial of 40.

A factorial is the result when you multiply a number by every number less than itself and a factorial is expressed by using an exclamation mark so that 5! Means FACTORIAL 5 or in long hand 5*4*3*2*1 where the * means multiply in common computer and calculator parlance. 5! Is 120.

This challenge means you have to work out how to do high precision maths and the usual 13 digits the TI works with are not enough. Try the program to accept an INPUT for the number you wish to obtain a factorial of. What are the limiting factors? (If your system baulks at 40! try 20!).

Puzzle Six

Another from Brain Teaser For BASIC Computers.

My telephone number is the smallest number equal to the sum of 2 cubes - in two different ways. Eg: using four different numbers which are cubes; A B C D and E, my telephone number equals A + B and C + D. A cube is a number multiplied by itself and then multiplied by itself again so that 13 cubed is 13 * 13 * 13. Submit a BASIC program to calculate the answer!

A comment on puzzle 3 (last issue) indicated a concern with accuracy in divisions. To solve the puzzle, accuracy is not an issue, but there are several ways of restricting the accuracy to that which YOU want rather than something the computer throws at you! The TI is a pretty good computer in terms of maths accuracy, but sometimes an unprinted digit (the last digit is not printed) may throw a relational term. If you can afford accuracy to, say, three places of decimals then instead of using ABS (A/B) to possibly obtain a wrong number when A/B = 4.9999999999999 and prints as 5 you can use, say, ABS (A/B+.0001) which would deal with almost all accuracy issues.

One member suggested puzzle three would require 18 hours... nope. The target time is hugely less than that! Look again and see if anyone can submit a program for next issue!

Thanks to Jon Murphy of Dortig who sent in two disks of programs for text to speech - alas my Myarc card uses the same tags so text to speech hangs the system, but Jon's two disks are available from the library and are intended to read to you DV/80 files. One disk is based upon the TI text to speech program modified for faster loading. The second disk contains a different format text to speech program by Jon Kneer and Mr. Murphy advises that this format requires your own XB programs to be somewhat shorter (under 48 sectors) and may crash on exit. Thanks to Jon Murphy for sharing these with us.

Speaking of crashing on exit, I am reminded that the programs written by Bruce Harrison (who has added a significant number of programs to the TI community) tend to crash on exit on my system. Here I am talking about fairly recent assembly programs which have an XB LOAD program. Bruce has suggested using QUIT but as my system is TOTALLY hung that does not work! Apparently Bruce has used an unusual return routine at the end of his assembly programs:

```
LWPI >83E0
     *load GPL workspace
B    @>6A *goto GPL interpreter
```

Address 6A may not be common to all TI consoles or possibly there is some other assumption made that does not accord to my system. It will not always work when the Funnelweb loader is used as the data Funnelweb

requires to return is not always left intact, resulting in a system crash.

There is a fairly straightforward (!) way of dealing with this by substituting the more usual BLWP @0.

First copy your disk (never mess with your only copy) then use a sector editor (several in library eg DSKU) to search for hex string:

0460006A and change this to:
04200000 and of course write the amended sector back to disk.

October 1996

Additional items in the disk library:

TI Inventory

by Ted A. Stringfellow. Extended BASIC household inventory database program to record all you valuable possessions for insurance claims. Fixed format records Item, Model, Make, Serial Number, Cost, Date Purchased and a free form comments field. Also totals up cost of all items entered.

Press

Yes the word processor advertised so long ago - some of you may have sent money for it! It will not be finished - this is the beta version of 9-1-89c which allows you to create, edit and save in its own unique format. Most other options are non-operational. Authored by Charles Earl.

Sound Lists Disks

Technical material for advanced programmers in assembly or C from Bruce Harrison.

Sound Lists In Assembler

A how-to disk with object and source code to examine.

Sound Lists In C

A how-to disk with object and source code - 2 disks.

Sound Lists 1168

With music in source and object format, these 2 disks present an alternative way to program music by means of lookup tables and mnemonics using form:

```
BYTE 4,GEN1+C4A,C4B,GEN2+E2A,E2B
```

Still no submissions of answers to this one:
PUZZLE 3 taken from 'Brain Teasers For BASIC Computers' by Gordon Lee.
Here are four numbers: 1731 5363 7179 9903
All you have to do for this puzzle is to find the LARGEST number which can be divided into these four numbers, leaving the same remainder for each one. Easy. Looking for a program to do the work please! One clue to save you some time: the largest number is less than 1731.
With a total lack of interest a quick and simple solution:

```
10 FOR N=1731 TO 1 STEP -1
20 R=1731-N
30 IF R>N THEN 20
40 A=5363-R
50 B=7179-R
60 C=9903-R
70 IF A/N-INT(A/N)<>0 THEN 120
80 IF B/N-INT(B/N)<>0 THEN 120
90 IF C/N-INT(C/N)<>0 THEN 120
100 PRINT N
110 STOP
120 NEXT N
130 END
```

If N is the number we are looking for we keep subtracting it to find the remainder R for each possible value of N. Having obtained the value of R to test we deduct it from each number and then divide the result by N to see if there is a fraction.

In this case the legendary accuracy of the TI is adequate for the case... but what if there could be an invisible thirteenth digit to throw the comparisons awry? We could use: `IF ABS(A/N)-INT(A/N))>0.00000000001 THEN 120` and have quite enough accuracy for this puzzle! We not be looking for an equate with 0 but only with an equate with just enough distance from 0 to ensure the computer has not thrown our calculation.

Trevor Stevens

From The Chairman's Chair

Hi gang! Summer has nearly ended and the trees are turning that funny shade. Christmas and the snows will only be a little while ahead!!!!!

However this allows me to spend more time on my keyboard doing what I love best, computing. I am not going to waffle on to you so I will now get down to the second part of my multi part articles, in the 9900 machine language and how to program your machine mainly from MINI MEM but this also works for Editor Assembler.

We discussed last time the basics, so now we can progress towards our very first programs. There is one thing you should know first and that is DIRECTIVES. No not detectives, directives!!

The Minimem has seven directives. They are AORG,END,SYM,EQU,DATA,TEXT. I will explain this in depth in a short while. Editor Assembler being a bigger and much more professional package has 28. In that you get all the LBL directives and others like, BES (block end symbol) COPY (for files) DEF, REF, (For setting up external names and definitions) to name but a few.

So lets start with AORG. AORG = Absolute Origin. This helps you move from one memory location or address to another. This command can be used in or out of program to correct or find bugs, but starting a segment of a program from that address. So if you want to start at your program on the LBL at 7E00 you do this:

```
7D00 045B AORG >7E00
```
when you press enter you get
```
7E00 04C3
```

Load up your minimem and LBL and give it a try.....

Remember to put the AORG in the OPCODE field, so press the spacebar twice before typing AORG once again for >7E00.

Try jumping around in memory your self, pick out an address between 7D00 and 7FFF

END directive shows the computer the end of your program. However it does not stop the program as in Basic. The END allows you to get out of the assembler.

So if you type:
```
7D00 045B END
```
press enter
You see:
```
0000  UNRESOLVED REFERENCES
```
This message tells you that all your labels in the operand field actually appear in the label field. This is telling you that the program has all the bits matching. Press the enter button twice more and you get to the mini memory main screen. You could now run your program.

If you get a message indicating that you have unresolved references then hit any key OTHER than the ENTER key, and you will go back to the assembler.

You can find your problem child by using the SYM directive (coming up in a tick) sort the problem out and END again.

The Sym Directive

This means the Symbol Table Display. This shows you a Table of resolved and unresolved labels used in your little program. So to use we type in as so:
```
7D00 045B SYM
```
Press Enter
If no labels have been used nothing will happen. Now enter the following line at 7D00
```
SN JMP RQ
```
Now type
```
7D02 C101 SYM
```
You will see:
```
RESOLVED REFERENCES
SN - 7D00
UNRESOLVED REFERENCES(JUMP)
RQ - 7D00
```

This shows you that you have one resolved reference SN at memory location 7D00 and a unresolved reference RQ at the same address, as you are trying to find a RQ which is not yet written. Its like trying to jump to a line number that is not there. If you add that extra line

number then we would put this, RQ CLR R0 so you will see this:-

```
7D02 04C0  CLR R0
```

If you type sym on another line you will find you have resolved all your references.

In a program you are allowed to refer to a yet undefined label. When you do this, an R appears between the memory location and the contents. Later on, when you define this label (add the label in the label field), an asterisk * is printed for each resolved reference along with the memory location to that reference. Try this for size:-
Add to the program above started, at 7D04 LI R7,TX you will see:-

```
7D04 0207  LI R7,TX
```
Press enter
You will see this,
```
7D06R0000
```

Notice the R in this string of characters. Now on the next Now type SYM
You will see

```
RESOLVED REFERENCES
RQ - 7D02 SN - 7D00
UNRESOLVED REFERENCES (WORD
)
TX - 7D06
```

This unresolved reference is as before, trying to find something that is not there. However because it is not in a JMP (JuMP) instruction it puts in as a Word.

When you write in assembly it is very common to ref a label and then forget to add the label to the program. If however there are more than one reference to that label up to 32 refs can be displayed.

Next we come to the EQU (equate) directive.

This little command lets you get round lots of things. It tells things to be equal to one another.

So if you tell a label to be equal to a memory location it will do it.
ie.
```
7D00 045B AB  EQU >7FEE
```
AB now equals (=) 7FEE

you can do this with labels as well, such as NH EQU BB this makes the values in NH the same in BB Once you have assigned a value to a label there is no directive in LBL available to change it. Enter this:-

```
7D00 045B    T7  EQU 118
7D00 045B    T7  *ERROR*
```

So if you try to give T7 another value after giving it 118 then you are stuck with it. So beware.

The DATA Directive

The DATA, or word initialisation, directive places values in the memory locations you are currently at. These values might be different data tables, character definitions, and to on. Some examples of these data statements are as follows.

```
7D00 0000  DATA 0
```
(Places zero in 7D00)

```
7D02 3589  DATA >3589
```
(places value >3589 in location >7D02)

```
7D04 0100  DATA 259-3
```
(Places value 256 (>100) in the location >7D04)

```
7D06 XXXX  DATA XN
```
(If XN is defined, places value of >7D06 in label XN else it add the value to the label when it is defined)

```
7D08 0001  DATA 1,0,>34
```
(Place a 1 in 7D08 a 0 in >7D0A and a >34 in 7D0C)

In other words, the data directive is used to initialise one or more memory WORDS to a specific value. You do the multiple consecutive locations by using a comma. (see above at address >7D08).

Data can be used to place special values at special memory locations say into a sprite, colour, sound table or into a custom character set. For example the following CHAR statement would change character 42 in BASIC.

```
CALL CHAR(42,FFA23491820100FF)
```

In assembly the pattern would be written as follows.

```
7D00 FFA2 DATA >FFA2,>3491,>8201
,>00FF
```

As soon as you press enter you will see:-

```
     7D02 3491
     7D04 8201
     7D06 00FF
     7D08 XXXX      ( XXXX IS THE
NUMBER IN THE LOCATION)
```

This however only places the definition into the memory it does not define the CHAR, like in BASIC. So when these values are put into memory you must put them in a area of memory that will not be OVER WRITTEN by your program. So place all you data at the end of your program. This will also avoid the program picking up a data statement in the centre of your program and thinking it to be part of the main program and get confused.

Bss Directive

The BSS (Block Starting with Symbol) is similar to the DATA directive. It reserves a certain area of memory for the program to store information. BSS reserves a specified number of bytes, without setting them to any value, which is unlike the data directive. Its a bit like setting up your own scratch pad. Try this:-

```
     7D00 045B BSS 32
     7D20 XXXX
```

You will note the next free address is 7D20, so you now have reserved 32 bytes from >7D00 to >7D1F

Again be careful not to have this area of memory used by the main program, else it will overwrite it.

A good example of the BSS is when you perform a equivalent of a BASIC INPUT statement in assembly.

Suppose you want to accept words up to say ten letters long. You would reserve a ten byte area to store the word in. (Each character is one byte).

It would be written like this:-

```
7D00 045B T3 BSS 10
7D0A XXXX
```

This gives the label T3 the ten byte memory block from >7D00 to >7D09

You will notice that the memory counter always increases value in two byte counts (WORD). So if you specify an odd number in the BSS the value is rounded DOWN

```
7D00 045B BSS 5
7D04 XXXX
```

The values can not be minus values with the BSS directive and a 1 or 0 returns you to the original location with no reserved memory. Give it a try!

The Text Directive.

This completes the last of your directives. TEXT is a way of storing text in your program for output at a later time. For example

```
7D00 045B TEXT 'COMPUTER'
```

When you press enter the TEXT is placed into the memory locations as follows

```
7D00 434F
TEXT 'COMPUTER'
7D02 4D50
7D04 5554
7D06 4552
7D08 XXXX
```

What happened is that the assembler converted each character to its HEX value in the ASCII code. ie

C = 43 O = 4F and so on.

This uses up memory so keep text to a minimum. If the string is a odd number it will add a extra hex number of >00 using more memory ie

```
7D00 4845 TEXT 'HELLO'
7D02 4C4C
7D04 4F00
```
(4F00 the 00 is extra)
```
7D06 XXXX
```

Before we crack on with any programs we must under stand some basic things. I will now discuss VDP.

No it is not a medical term or something from outer space. VDP is the Video Display Processor. This gives you the power to display things on the screen.

To display things on the screen in assembly you use built in routines that you use in your program. These are,

```
VSBW = VDP SINGLE BYTE WRITE
VMBW = VDP MULTIPLE BYTE WRITE
VSBR = VDP SINGLE BYTE READ
VMBR = VDP MULTIPLE BYTE READ
VWTR = VDP WRITE TO REGISTER
```

So to write one byte to the VDP you will use the VSBW.

Though in the next example we display the byte on the screen which forms part of the VDP RAM, keep in mind that the byte can also be written to other areas of memory.

The VSBW requires certain values loaded into specific registers (registers 0 and 1) before it can be executed.

We normally write R0 and R1 so we can see what we are doing. However you can refer to the register as 1 or 0. In R0 you must load the memory address you want to write the byte to. If you write to the screen you write to screen location 0 to 767 (decimal).

The screen is 32 cols by 24 rows which is 768. However you are using option base 0. so 0 is the first position. So to work out where you want your display count the number of lines BEFORE the line where you want to display the character then multiply this number by 32, add to this value the number of spaces in the next line to leave blank before the printing position and you will have the correct memory location to load. ie:- to display a byte in screen position row 12 col 7. Multiply 11 (The line before 12) by 32, then add 6 blank spaces (Before col 7 = 6). So the maths is (11 * 32) + 6 which equal 358

Got it????

Once you load R0 with the printing position, you must load the hexadecimal ASCII code of the character to be displayed into the LEFT BYTE of R1. You do this by loading the data with LI (Load Immediate). Then you branch to the VSBW routine to write the byte on the screen. To branch to that routine use the BLWP (Branch and Load Workspace Pointer) or Bullwhip as Richard Twyning calls it. This works like a GOSUB in basic.

Problems!!! you are not allowed to branch in LBL to a name like this.

BLWP @VSBW (the @ means AT and must be included before the name or position in memory)

You can however do this in the Editor Assembler. You can refer to the routine by name if you EQU (EQUate) the name, like this.

```
7D00 045B VS EQU >6024
7D00 045B BLWP @VS
```

However this uses valuable memory. So why not use this instead.

```
BLWP @>6024
```

It means exactly the same thing. If you look at pages 35 and 36 of your mini memory manual

you will see all the memory locations for the util routines. Some will be in the module ROM its self. In the flick of an eye the character will be displayed.

Before you finish you must end your program correctly by stopping the execution else the computer will continue to process other memory areas.

You can create a endless loop like 1000 GOTO 1000 in basic. In assembly this is nearly the same:- BB JMP BB

Your First Program In Assembly

The display on the screen program is as follows.

Displayed Your Fields

```
7D00 02E0 LWPI >70B8
7D02 70B8
7D04 0200 LI R0,367
7D06 016F
7D08 0201 LI R1,>2A00
7D0A 2A00
7D0C 0420 BLWP @>6024
7D0E 6024
7D10R10FF NQ   JMP NQ
7D10*10FF
7D12 XXXX END
```

7D10R10FF Can be written like this B *R11 Here the B is in the instruction field, and not a label.

Type this in and run from easy bug. You do this by typing end as above. Press Function Quit and return to the title screen. Select easy bug and press any key to skip title screen. A question mark (?) will appear. Type E7D00 then press enter. The E tells Mini Mem to Execute the program starting at 7D00.

After you press enter you will see an * displayed. You can give your program a name but this will be discussed later in the series. You will notice that your computer is now HUNG. Do not panic just turn your computer off at the switch on the front. There are ways around this too, if you put the line in above B *R11 instead of the endless loop will put you back to Easy Bug.

Saving your first program is easy. If you do this before you execute you will not lose you program and can reload at a later time. In easy bug press any key to get by the title screen. you will see the question mark (?).

Type S7D00 PRESS ENTER there is then a prompt which says TO type in 7D10 PRESS ENTER this will save these memory location onto your tape recorder by following the cassette prompts. In this case we only save a very small area of memory. If you are writing a large program save all you programs from 7D00 TO 7FFF this way you will be sure not to miss any thing.

In the next part of our series I will discuss the program we just wrote. I will show you how to use VMBW,VSBR,VMBR,VMBW and VMBR. I will give you some more programs to try out, and we will discuss them. If I have the time we will go onto discussing how the maths works.

I hope you are finding your way round your mini memory and now have a little insight into how it works. Hopefully at the end of this series you will be able to write a bit of assembly yourself. It is quite easy and will modulise if you save the routines. So when we look at small pieces of code do not throw them away. Use them later.

Any problems write to me at the address in TI*MES or leave me a EMAIL message on the TIUG BBS the MOBB on UK 01623 491282.

Memory full Fctn - Quit.

```
**********************************
*                                *
* REMEMBER YOUR BBS.(THE MOBB)   *
*                                *
* OPEN NOW 7PM FRIDAYS TO 10PM   *
*            SUNAYS              *
*                                *
* CONTACT ON +44 01623 491282    *
*        8N1 FD 19200BPS         *
*                                *
**********************************
```

News And Reviews

Dear TI'ers,
Well, how's things with you all out there? I've been a bit worried recently about the state of the group, mainly because the Autumn newsletter is behind schedule.

BBS Problems

Now there's something else to worry about, because the BBS is out of action. In fact, it's the hard disk controller that's out of action. Trevor sent it across to Ross Bennett to fix again. Ross did his best and repaired what he though the problem was, and he managed to test the floppy disk side of things, but since he didn't have a hard disk, he wasn't able to test hard disk operation, so when Trevor tested it again, there was still a problem with the hard disk side of it. Trevor has sent it back again with a hard disk so Ross can fully repair and test it, but in the meantime,

Trevor has managed to get my PC bulletin board running on his KCS PC-emulator on the Amiga. It's called Wildcat BBS, and I got it free with a book called "Running The Perfect BBS". The only reason I bought the book was because it had a full list of ANSI codes in the back. Wildcat is far from perfect, just like most PC software, and it makes us realise just how good S&T and other TI software is. It seems so reliable and easy to set up and use compared to PC software.

Apology

Well, I'm sorry if things have seemed a bit quiet lately. I will hopefully be back on form soon with my big articles, and I want to track down an official and complete group membership list to make sure our members are getting the support they deserve.

I've got ideas to re-vitalize the newsletter, and in situations where the newsletter is delayed, we need to instate our intermediate leaflets to explain that the group is still here and to show that we are still dedicated to keeping the 4A going.

More SCSI Problems

I'm at a standstill with my TI projects, because I haven't got the SCSI card running. But my card does work, and it works brilliantly. Jeff Kuhlnman came over to Sandbach in February with his card, and a SCSI drive that he bought from Bud, and we tested my card with his drive, and it was FAST, and worked perfectly.

My problem is that I don't have a formatting program to format my SCSI drive or optical drive, so I haven't been able to use it yet, and this is what's holding me back, because I want to move all of my valuable floppy collection onto SCSI drives, and optical disks.

From Lima User Group "Bits Bytes and Pixels" June 1987
Cassette loading of Assembly programs.
Text by Mel Nomina, software by Tom Freeman

We have lots of high quality Assembly Language software in our group library, but you need a disk system to use it, right? I thought so too, but I was wrong.
Those with a tape only system can now load and run from tape any program image Assembly Language program (E/A 5) in our group library IF (and only if) you also have a standalone 32K and the E/A module.

All you need to do is get a friend to use the software below and save E/A 5 programs off of disk to tape for you.

Just load the tape/disk file from TI Basic with the E/A module plugged in and follow instructions. You can't use Funnelweb to load this software. This software (which must be loaded from disk) will convert disk program image files to tape, or tape program image files to disk.

Once assembly programs are saved to tape this is how the tapes are loaded. Remember, you need 32K and the E/A module.

1. Select 2 for Editor/Assembler

2. Select 5 for RUN PROGRAM FILE

3. When asked for PROGRAM FILE enter "CS1.X" (don't just enter CS1).

4. You will then go through the normal tape loading instructions.

5. If there is more than one file to load you will be asked to REWIND CASSETTE. If the files are one after the other, don't rewind, just keep loading. When everything is loaded, the Assembly Language program will auto-start.

6. Have fun!

The first listing is in TI Basic. It should be typed in and saved to disk using any file name that is convenient. The second listing is assembly code that should be typed in using the E/A or Funnelweb editor and then assembled using the E/A or Funnelweb assembler. The object file name should be DISKTAPE/O.

Basic listing

```
10 REM "By Tom Freeman"
100 DNAME=4096*3+9
110 CALL INIT
120 CALL LOAD("DSK1.DISKTAPE
/O")
130 INPUT "DISKFILE TO SAVE/
LOAD          ":NAME$
140 LE=LEN(NAME$)
150 CALL LOAD(DNAME,LE)
160 FOR X=1 TO LE
170 CALL LOAD(DNAME+X,ASC(SE
G$(NAME$,X,1)))
180 NEXT X
190 PRINT :"PRESS D. DISK T
O TAPE":"OR        T. TAPE TO D
ISK"
200 CALL KEY(0,K,S)
210 IF S=0 THEN 200
220 IF K=68 THEN 260
```

continued...

```
230 IF K<>84 THEN 200
240 CALL LINK("TAPDIS")
250 GOTO 270
260 CALL LINK("DISTAP")
270 PRINT :"DO ANOTHER? Y/N"
: : :
280 CALL KEY(5,K,S)
290 IF S=0 THEN 280
300 IF K=89 THEN 130
310 IF K<>78 THEN 280
320 STOP
```

Assembly listing

```
*************************************************************
*              Disk to tape and tape to disk                *
*                    conversion program                     *
*                                                           *
* by Tom Freeman                    Published by permission *
* 515 Alma Real Dr.                 of Tom Freeman          *
* Pacific Palisades, CA 90272       Thanks, Tom! Mel        *
*************************************************************
* LA-99ers                                      -3491454312-
* PO Box 3547
* Gardena, CA 90247-7247
*
* For use with programs meant to be loaded by the RUN
* PROGRAM FILE option (#5) of E/A. It may be used for
* other, non-standard, files, but in that case the two
* instances of BL @ change should be deleted, and the

*  4th word of each PAB should be replaced by >XX00,
*  where >XX is the hex equivalent of the number of
*  sectors taken up by the program (per disk catalog)
*  minus 1. If the original file is on tape and this
*  number is not known, use >2F, then check the disk
*  file with a sector editor to see where 00s begin.
*  The program can then be re-run with the proper number
*  Note: Because of the FEFs to GPLLNK and DSRLNK, the
*  program will only work with E/A. It is called
*  from Basic.
*
```

```
*
        DEF TAPDIS,DISTAP
        REF DSRLNK,GPLLNK,VMBW,VMBR
STATUS EQU >837C
FAC     EQU >834A
PAB     EQU >0F80
PNTR    EQU >8356
WS      EQU >8300
        AORG >3000
*
* The following is the disk file
* and has been prepared from Basic
*
PABDSK DATA >0500,>1000,0,>2000
        BYTE 0
        BYTE 0
        BSS 15
*
* The following is the cassette file
* Note: if using CS1 for input in
* "Run program file" in E/A use
* CS1.X as device name, NOT CS1
*
PABCS DATA >0600,>1000,0,>2000,>6003
CS1     TEXT 'CS1'
SAVE    BYTE >06
LOAD    BYTE >05
SAVRTN DATA 0
DISK    LI 0,PAB
        LI 1,PABDSK          * Load PAB for disk file
        LI 2,25
        BLWP @VMBW
        LI 6,PAB+9
        MOV 6,@PNTR
        BLWP @DSRLNK
        DATA 8               * Move file to VDP at >1000
        RT
CHANGE LI 0,>1002            * 2nd word contains # bytes in
        LI 2,2               * file and belongs in the 4th
        BLWP @VMBR           * word of PAB (R1)
        RT
TAPE    LI 0,PAB
```

CONTINUED ON THE BACK PAGE...

The Orphan Chronicles

The Orphan Chronicles
By
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Acknowledgements

How does one thank both his "families" for a completed project? My first family, my wife, Louise, and my children, Rhonda, Ronnie and Danny, tolerated my mental (if not physical) absence with a patience and understanding that can only be described as akin to Solomonism. Thank you, my dear ones, for allowing me to have a dream come true.

My second "family", the brothers and sisters of the TI-99/4A user community also contributed. To Howie Rosenberg, my constant confidant, confessor, and advice-generator, I couldn't have done it without your constant encouragement. To Scott Darling, Jim Horn and Barry Traver, thank you for letting me use your material. Terrie Masters, Ralph and Dolores Landrum, Warren Agee, and Don Plorde kindly submitted archival materials for review. Don Bynum, Richard Mitchell, John Koloen and Laura Burns, Dave Wakely, your candor and honesty made the book come alive for me. To the others interviewed, your time was truly appreciated. To all my friends on CompuServe's TI Forum, you helped me immensely with your recollections and memories I extracted in such a clandestine manner. And you never knew you were writing a book (grin).

When first conceived, I had no aspirations of having this material made available to a widespread audience. I, quite frankly, planned to publish it myself and give away 15 or 20 copies to some of my TI friends as presents. One of them was to be Craig Miller. Craig read the draft and decided that others may enjoy it and went out on the proverbial limb to make more copies available to others. For his confidence and support, I will be forever grateful. And to Sue Miller, who had the unenviable task of running the files through a spelling checker and formatting my ramblings, your efforts were Herculean and appreciated.

And to all the incredible enthusiasts of the Texas Instruments 99/4A Home Computer, who have made the story possible to tell, I hope we can write Volume II of the Chronicles two years hence. I am grateful for all this help; whatever errors there are in the text are mine.

There are no "good guys" or "villains" in this book. It is a non-fiction account of the facts as gathered by the author and based on his INTERPRETATION of these facts. An interpretation is an individual evaluation and should be accepted as such. Another writer, given the same facts and experiences, would almost certainly write a different book. The point is that the author made no attempt to portray anyone in this book in anything but an objective light. The author only presented the facts as he viewed them. If anyone in the book appears to any reader as a hero or a villain, that is entirely through their individual interpretations as no distinction of that type was intended by the author. The material which appears in quotations is factual and concise. Any other material in the book, should be considered as an interpretation of the facts, and as such may or may not be considered the truth. It is the truth only in the eyes of the author.

Introduction

In a 10 page historical abstract of the history of personal computers appearing in Byte magazine (September 1985), the authors used a single paragraph for the Texas Instruments 99/4A Home Computer. They wrote:

"June, 1979. Texas Instruments unveils the TI-99/4, which originally sold for $1150 (which included a color monitor).

The machine is slow (even though it uses TI's TMS9900 16-bit processor), the button-style keyboard is oddly laid out, and TI discouraged third-party software. The revised TI-99/4A solved some of the problems, but TI finally discontinued the computer in late 1983; its close out price went as low as $50."

In those few short sentences, the authors told the essence of the life of the TI Home Computer. But the story goes far beyond the mere essence. It is the story of corporate mistakes, marketing errors, price wars, personalities, and consumers. All that remains of that story are the last of the consumers. Texas Instruments, indeed abandoned the home computer marketplace in October of 1983. The owners of the TI-99/4A have yet to abandon the machine. While some have either given up on the fantasy that home computers would make their lives suddenly organized, smooth-running, and neat or accepted the predominant advertising hype that "newer is better" and bought a new machine, a large number of owners have clung tenaciously to their 99/4A's with almost cult-like loyalty. They have fought against the industry's odds that dictate once a machine has left production, it can no longer be supported by consumers or producer's for any extended period of time. And they remain. Despite their confinement to the "industry orphanage", they have learned certain survival techniques and have aided each other to keep their machines even more productive than they were when Texas Instruments was actively supporting them. It is a story worth far more than a single paragraph. And so it shall receive its due here.

Why the "Orphan Chronicles"? This book is named so after what has become a phenomenon occurring with increasing frequency in the still-fledgling computer business. Being "orphaned" means that, after buying a mass-marketed product of considerable cost and expected useful product life, the manufacturer leaves the market and produces neither the product or its support technology any longer. The firm may continue to support in warranty and maintenance, but they declare they will no longer produce the computer or peripherals of software and, thus, leave the consumer without the growth and enhancements which come to their computers when marketing is continued. They are "orphaned", abandoned and passed by in the industry mainstream.

In perhaps no other industry have so many consumers found themselves with an expensive purchase without support of the original manufacturer. It has been estimated that there are well over 4 million purchasers of Texas Instruments, Coleco, Mattel, and Timex-Sinclair home computers who have found themselves "abandoned" by their computer's "parent". The cold reality of being "orphaned" has even hit the owners of IBM products, as the much belittled "Peanut" was also brought out of production. It is likely to occur again as those who have, perhaps, overestimated the home computer market continue to face the shake out period.

This book has been written with two goals in mind. First, to chronicle the survival technology developed by the hearty users of the TI-99/4A who, two years now after their computer's abandonment by its manufacturer, continue to be productive and even prosperous with their computers by mutual support and ingenuity. It is a tribute to these users that this book is written. Secondly, the book may serve to point to ways others already in the "orphanage" or who will join in the future, may survive and flourish in the difficult, but definitely not fatal computer orphanage.

Chapter 1 - One Computer's Sad Story

Texas Instruments is a huge semiconductor producer which had risen to corporate success by marketing its products to other companies (see Appendix 7 for a current publicity sheet from TI itself). The Dallas-based giant had already made major contributions to the "history of computers". In 1954, TI was the first company to make silicon transistors. Jack Kilby had made another major coup there in 1958 when he made the first integrated circuit (IC). And they are even credited with building the first IC-based computer (for the Air Force, in 1961). They assumed prominence in the modern computer industry by making and successfully selling the TMS1000 chip, a 4-bit microprocessor that rapidly became a best seller in hand-held calculators and games, with estimates of more than 100 million being sold. Through research and development, they were able to follow the 1000 with a second generation chip, the TMS9900, which was not the expected multiple of 4-bits. Instead of just keeping pace with the

industry standards, they leap-frogged 8-bits straight to 16-bits with the 9900. Unlike the 1000, the 9900 was a marketing failure. The other manufacturers were not ready to advance so far so fast and opted instead to build their new computers on 8-bit technology. The computers being marketed at that time (1976-1977), all went with 8-bit chips, leaving Texas Instruments with a "chip in search of a computer", and a huge research and development expenditure to make up.

But TI had always been the pace setter in the industry and refused to back down from advanced technology and build what the industry wanted. They did not build an 8-bit chip. What they chose to do was typical TI. They would build a product within the corporate family to use the 9900, "sell the chip to itself", thus covering the research and development costs, and end up selling a new product to boot. Certainly, they expected to turn profit in the process, but one gets the impression that showing their advanced chip was the right choice for the main goal; to save corporate "face", if an oriental metaphor can be used for a Texas electronics firm.

TI chose the consumer-products group, recently moved to Lubbock, which sold the almost successful watches and the successful pocket calculators, to make up the R and D losses. They were tasked with designing a home computer which would feature the TMS9900 chip, and be sold to the consumer market, proving the industry leaders were wrong about the 16-bit processor. Corporate pride, at least at Texas Instruments, is a powerful force indeed.

While there were already several computers on the market, TI was going to direct their new computer at a new market: the home user. Apple and Tandy were selling computers, but expensive ones, geared primarily for business applications; Commodore was selling the PET, but only with major success in Europe. TI felt it was time to open up the home to computer technology and, to do so, would have to build a less expensive model. A "computer for the masses" was the goal. Applying the same philosophy that they had used to sell millions or watches and calculators, getting the volume up and price down, they planned on building and selling the first "home computer".

As put forth in "Megatrends" (John Naisbitt, Warner Books; 1982), new technology advances, in its first stages, in the "direction of least resistance". TI predated that premise. Their home computer would be directed to least resistance". Rather than trying to sell a computer as a replacement for the home typewriter, or the account sheets, they would sell their new computer as a means to educate the children. Certainly, it would play games (an absolute MUST in the early days and also a less threatening advance). The "advanced" home applications (word processing, spreadsheets) were surely planned but, first, one had to make the computer attractive to an entirely new market and education became TI's marketing cornerstone.

They had projected a $400 machine. After getting the expanded touch of an over enthusiastic engineering department, they had put together a $1000 machine. (Of course, since TI was making its own chips, the price could have been much lower, but they sold "to themselves" at retail and expected the consumers to finance the 9900 developmental costs.) Having little idea what would be involved in building a new computer and having difficulty enticing experienced computer engineers to leave northern California for Lubbock, in-house engineers grossly exceeded marketing cost projections. Further, being novices in the computer market, they made a fatal error in their new machine. It was the keyboards of the time, the TI keyboard was no better that the awkward keyboards used on their pocket calculators. Two-thirds the size of a full keyboard and 40 small "chicklet" keys protruding through a plastic membrane marked the fatal flaws of the 99/4 computer. It was awful. Further, there were no "lower-case" keys; only capitals (thus impossible for word processing). No ALPHA-LOCK (not needed, obviously) and lack of function keys were minor in the face of other dreadful imperfections. On the plus side (if there was one) was a built in "calculator

function" which placed two "windows" on the screen; one could place an equation generated in the lower window into the top window, then, pick values for any variable in the equation and watch the values for the other variables change in the top window. Similar to a one-cell spreadsheet. A nice function but even further cementing the 99/4 connections to the calculator machines. Even the timing for introduction went askew and portended ill; engineering bugs forced the 99/4 into early 1980, missing the 1979 Christmas debut (and sales) that had been projected. If corporations developed believed in omens, the 99/4 was a walking voodoo doll.

The reviews of the machine were entirely negative. One after the other, Byte, Creative Computing and the major journals wrote the 99/4 off merely a toy. Not only for that ridiculous keyboard but for the flaws in the BASIC language burned into the computer's ROM chips. It had no "peeks", no "pokes" (the computer hobbyist's favourite way of changing the way a machine runs) and, worst of all, no Assembly Language capability. Thus, the press said that the 99/4 was not only not a good home computer for word processing, but it was equally bad for the hobbyists who couldn't Peek 'n' Poke at the BASIC language. The only positive comments made were that its size was "manageable" and that its lines were "almost stylish". Otherwise, the message was clear: consumers look elsewhere.

And the consumers did so. After millions in research and development, TI;s entry computer was a consumer flop. Peter Bonfield thought it was due to the uniqueness of the 9900 microprocessor. He set out to redesign the machine around a more standard Z80 chip, an 8-bit chip. The project was not popular with CEO Mark Shepperd and Chief Operating Officer, Fred Bucy. The decision was, again, based on in-house pride and the behest of Don Bynum, a supervising engineer assigned to TI's Corporate Engineering Center in Dallas.

Bynum was the "problem-solver" of the engineering branch. Educated at the University of Texas, he had joined Texas Instruments in 1968. He had spent successful tours in the Advanced Systems Design Group (working with the design of large TI mainframe computers), the Semiconductor Group and the last two years in the Corporate Development Group in the Dallas offices. When he saw Bonfield's new computer design, he began asking questions. What was TI trying to sell? The answer was a home computer. What would it be used for? Education, home productivity, and entertainment (probably in that order). What educational software was available to run on the Z80 chip (basically, CP/M software)? Answer: none. Which chip is easier to write educational applications for? Bynum thought the 9900. Bynum, then, began investigating price. What was the price of the Z80 chip to TI? About $6. And the 9900 (would have to be bought from TI's Semiconductor Group themselves)? About $17. What about the true cost to TI to produce the 9900 chip? $2.25. Once the facts and figures were gathered by Bynum and presented to the TI corporate hierarchy, the choice was clear. To build a Z80-based machine was, simply, too expensive for TI for their proposed marketing plan. It would be, roughly, two and one-half times more expensive than a 9900-based machine. Bynum and his engineers then set out to build an alternative to Bonfield's Z80 machine. The "Ranger" (as in Texas Ranger) it was called. The machine kept the 9900 microprocessor but that was it's major selling point to TI (it was, clearly, more profitable). The keyboard and price were not really addressed. But that was all Bucy and Shepperd needed to hear - remaining profitable and keeping the 9900. The best of both worlds. The corporate heads loved the new design (it did, in fairness, successfully address the problem of attaching peripherals to the console), promptly moved Bynum into Bonfield's job and set him off on saving the 9900 project. Bynum later stated his "charter was to kill it or pull it out of the ditch".

The RANGER never left the TI engineering department. It still was too expensive, had a lousy keyboard and had no software. But it served a purpose. It showed the corporate heads that if Texas Instruments was to pursue the home

computer market, the most profitable avenue was with the in-house TMS9900 chip.

So, the course was set. The 9900 chip would be used in the redesigned computer. The keyboard problem was corrected. The /4A as it was called, even Bynum doesn't know why /4A, would still be only two-thirds size, but it has a standard configured 48-key typewriter keyboard. An ALPHA-LOCK and lower-case were added. There were function keys and an auto-repeat on all keys and a BASIC that would accept upper or lower case, and long variable names could be used (for ease of programming). The expansion port for adding peripherals was modified and, at the Summer Consumer Electronics Show (Chicago), the 99/4A was released. Price was halved to the consumer (down to $550). At the same show and, unfortunately somewhat lost sight of, TI also showed TI LOGO (the first licensed version of LOGO released) and their own computer specific section on The SOURCE telecommunications network (McLean, Virginia) which would feature TI graphics and music and would have downloadable programs for subscribers. These were two major innovations that TI never received adequate public notice for pioneering.

But problems remained. The biggest problem was not with the machine itself. It was with the whole concept of the "home computer". TI found themselves against a media problem which has not been solved even today. How does one convince the public that they "need" a home computer? What do they need it for? What will it make easier? How will it improve the quality of the user's life? Despite all the predictions (each of the past 2 years, 1984 and 1985, have been called the "year of the home computer", only to be let down by consumer lack of interest). TI was not known for their understanding of the consumer market and, now, they were faced with a product that required expert handling in that aspect. They couldn't handle it from within the corporation. They had to, reluctantly, recruit from without. They did and hired William (Bill) Turner from Digital Electronics Corporation.

Bill Turner was not an engineer; he was a salesman. He had been selling computers for some time and brought a new insight into the computer market. He had a knack for making sales projections and was ever the optimist. He also was unshakeable in his ideas about marketing a "home computer". According to Joseph Nocera in his article "Death of a Computer" (Texas Monthly, April, 1984), Turner had two tenets upon which he based the entire marketing strategy for the 99/4A:

[1] You don't sell home computers in "computer stores". Computer stores are for computer knowledgeable buyers; those who have computers or exposure to them at work. They want full-powered, full-featured machines and are going to spend more. Turner's theory was simple: if the mass consumer sees the home computer in enough sales outlets (achieving "market visibility"), they will begin to think that the neighbour has one, his work competitor has one, his son's school mate has one, and, by God, he's not going to miss out! He may now know what he will be doing with one but middle America is quite famous for "keeping up with the Jones" and anyone else that might get ahead of them. TI really struck at the "home education" aspect: "you may not need to know what a computer does; but little Johnny or Sally sure better". We'll touch more on this advertising ploy later.

[2] Turner's second tenet was that the price of the 99/4A had to be much lower. People didn't know or care that the TI was the only 16-bit home computer available; that it offered the most advanced speech capabilities of ANY computer; that it was built well and to last. People who buy a computer at J.C. Penny's or Sears will look at price and buy, usually, on a lark. (Remember now, we are talking about 1981-1982; people are much more sophisticated about home computers now).

At the first task (achieving market visibility) he succeeded. Turner got the TI computer on the shelves of all major retail general merchandising outlets; Sears, J.C. Penny's, Montgomery Wards, Toys 'R' Us, and even Kmart carried the computer (Nocera's article states that even 7-Eleven stores were almost signed just before TI left the market; imagine "I'll have a Slurpee and a TI to go!"). The sales were aided by the signing of one of America's most trusted and popular entertainers, Bill Cosby, as the company's standard bearer (at a mere $1 million per year). The price of the machine was dropped from $550 to $350 by June 1982 and sales were sky-rocketing. Cost reduction was done at the expense of design cutting (chips were eliminated from the machine) and the profit margin remained at 40%. Things looked great. The engineers and Bynum were not particularly enthralled with Turner's cutting down "their" machine, but who could argue with Turner's charts and "projected sales" graphs. Production (note I use the term PRODUCTION and not sales) of the TI was up from slightly less that 10000 machines per month to about the same number per week. Turner, in the jaundiced eyes of the TI corporate hierarchy, was a genius.

Another of Turner's ideas was the single handed, most fatal decision made in marketing the 99/4A. Turner knew enough about computer sales to know that the real profits centring around computer production was in the software sales. He knew if they were to cut the cost of their computer to the bone in order to sell to the mass consumer, profit margins could be buoyed by software sales. Thus, on Turner's insistence and against the strong argument of Bynum (who argued against the move all the way to Mark Shepperd's office), TI would not only make software for the machine but TI would be the only ones to do it. TI elected to produce a machine with a "closed architecture". That is, again going against computer industry standards (Apple and, later, IBM had pushed open systems and had more software for their machines than they could have ever produced themselves), TI would not make the inner workings and design available to the software producers. To do so would mean TI would lose profits. Instead, TI would keep the operating system in-house and, to the point of legal threats, discourage so-called "third party" software developers from writing programs for the 99/4A. And, it succeeded. No one wrote new or adapted old software to run on the new machine. TI did contract with a few select companies to produce cartridge based software, but, for the most part, the software was trivial and poor. The games were clones of existing ones ("MUNCHMAN" looked an awful lot like "PACMAN", "TI INVADERS" a lot like "SPACE INVADERS"). The software produced by TI varied in quality immensely; some were state of the art, others were terribly limited. Virtually all were cartridge based (see appendix 4 for a list of the marketed program titles). As TI was to learn, a computer is only as good as the software that supports it. It was a painful lesson, never realized by TI until much too late. (Don Bynum was to state, after leaving TI, "An open software policy would have actually reduced our costs. Instead of having to spend $20 million a year developing application programs, I probably could have spent $2 million a year helping third parties get their jobs done and maybe licensed the GROM technology to them and maybe gotten an extra 50 cents from them for every cartridge sold by them, not by us. I candidly think we would have been overwhelmed. No vendor can pick the best software; the consumer does that. TI thought, apparently, they could dictate to the consumer what products they could buy and it didn't work.")

Before long, the competition began to rear its head. While Atari had beaten TI to the "home computer" marketplace with the Atari 400 (also a 16 kilobyte machine, but 8-bit based), it sold for much more than the TI and didn't, in Turner's eyes, pose a threat to the /4A. So, at the start (1980-1981), TI felt alone and the only problem they had to deal with was convincing the public to buy their machine. But then, 9 months after the 99/4A hit the shelves, Turner and TI faced the challenge that was to be their downfall.

Commodore marketed the first home computer for under $300 - the VIC (for Video Interface Chip, the new chip that enabled the use of color television for a monitor) 20 for $299. After

virtually cornering the entire European home computer market with the PET computer, Commodore came home to do battle.

Turner and TI became increasingly greedy for their market share as their success increased. They, following tenet 1 above, went after the VIC 20 with price reductions. TI based their strategy on an assumed naivety of the computer consumer. Right or wrong, they thought that the buyer would only look at price when choosing a beginning home computer. The clear fact that the 99/4A was a much better computer in design, quality and capability was moot. Side by side, the consumer would buy the cheaper machine. This was another major mistake in the strategy of selling the TI home computer.

A failure almost as glaring as the final pull out from the market, was TI's failure to sell the 99/4A as, truly, a remarkable machine. It was a well made, solid, powerful, fast machine, much more computer for the dollar than the VIC 20. TI failed to go after this advantage. They either didn't think they could convince the buyers of the fact or thought it wouldn't matter at the cash register. In either case, they failed to promote the machine as being better than the VIC 20 and attempted to address that competition only on the basis of cost. At that level, they couldn't compete. The VIC 20 had 20 less chips and only 4K memory and an 8-bit processor. The TI had 4 times the RAM (Sorry Dr. Albright, but it had 8 times the RAM! The machine had 16K for the user, but had 16K totally separate RAM for VDP) and a 16-bit processor. Perhaps, TI was correct in thinking the consumer was not knowledgeable enough at that time (1982-1983) to make this sort of comparison; today it looks foolish to avoid that level of comparison. Even if they were right about the computer literacy of the computer marketplace, they could not manufacture the 99/4A at the cost of the VIC 20. (Commodore and their executives were vividly aware of this fact even if TI wasn't). But, with Turner calling the shots, TI would give it a try!

In the spring of 1982, the situation was this: The 99/4A was selling at $300, the 16K Atari 400 was $349, and the Radio Shack Color Computer was $379. Commodore shortly after reduced the price of the VIC 20 to $199 and the C64 to $499. TI announced that with the purchase of every 99/4A, the buyer would receive a certificate worth 5 hours of training at one of the 200 or so TI-staffed "Computer Advantage Clubs". Useful if you lived in one of the 100 major metropolitan markets served. Otherwise, you could get a cassette tape tutorial.

In early August, 1982, Turner fired the first shot in the "home computer wars". With the VIC 20 selling for $100 less than the 99/4A, TI announced a rebate of $100. The computer had already been cut close to the bone to get the price down from $550, so, with the rebate, the profit margin was halved by the rebate. Turner (recently promoted to Head, Consumer Products Division) skirted about that issue with the familiar argument that "the profits on 100 units with a margin of 20% is more than the profits on 40 units with a margin of 40%. In other words, volume will make up for lowered profit per item. But Turner and TI didn't bank on Jack Tramiel and Commodore. TI had beaten Commodore with a similar price war in the calculator arena and quite nearly drove Commodore and Jack Tramiel into bankruptcy. Tramiel and other Commodore veterans of those mid-1970's "Calculator Wars" learned a number of painful but valuable lessons from that conflict. How to build cheap and use in-house integration were two of the lessons. Shortly after those early battles were over, Tramiel sold stock in his company to obtain MOS Technology of Valley Forge, Pennsylvania. This firm developed the 6502 chip that was used in the Commodore computer line. Thus, Commodore had cheap access to essential computer components (even though they were crap! R.T.). Further, Tramiel relied heavily on Japanese assembly lines to cut production costs. This time, Tramiel was well prepared for the fray to follow. He was not about to let history repeat itself. The same day TI announced the rebate, Tramiel and Commodore announced a $40 price cut on the VIC 20 making the prices effectively equal. Tramiel was in a great position. The margin of profit on VIC 20 production was extremely high and he and CBM had a lot of room to maneuver. In October,

Tandy cut the price of the Color Computer $70, Atari offered a free 16K upgrade for the 400. One month later, the CoCo is dropped another $100, and Atari drops the 400 to $200. The home computer price wars had begun. And Tramiel had a smile on his face.

Despite the error laden path that would return to haunt him in the near future, the Christmas selling season of 1982 would portray Bill Turner as a genius. Production of the TI-99/4A skyrocketed. The retail network was well over 12000 stores. The 99/4A outsold the VIC 20 three to one. A small (by TI standards) corporate "sideline" had become a $200 million business. The TI-99/4A, at that time, was the leading seller in the home computer market.

At TI, it appears, success fathers greed. Turner was not content with just the middle level home computer market. The TIMEX-SINCLAIR, comparatively a toy computer selling for $100 was enjoying a modicum of success in the "first-buyer" market. Turner decided to go after that with a new machine. Further, he wanted a piece of the upper level market and set Bynum off to build a larger machine. Development of a fourth machine, a portable computer, the CC-40, was begun at the same time. Just as it was evident TI wanted all of the software market for their machine by keeping it "closed" and prohibiting third-party software production, they appeared to want all of the computer market as well.

The Winter CES of 1983 (Las Vegas) showed TI in the glitter typical of Vegas fantasy. The TI exhibit on Aisle 700 featured a sleek, shiny-black tower over two stories high that had to be transported to the show on six 18-wheel diesel trucks. Prototypes of the 99/2 and the Compact Computer (CC-40) were on display. The "voice-recognition" game expander (MBX) produced exclusively for TI by Milton-Bradley which featured software and a microphone to allow game playing through voice commands was also previewed. (MB contracted with TI to delay their introduction of the ATARI compatible MBX for a full year after TI's release; a major coup. But the MBX was never fully marketed by TI and ATARI reneged on its contract with MB before the unit was completed. MB lost on both ends despite producing an excellent product. Again the fortunes of the computer wars). And PLATO software was shown from Control Data, another TI tour de force. Though CDC would market the PLATO to Atari and Apple, TI had a separate agreement which gave them exclusive rights to 500 PLATO programs organized into 108 software packages. If it were completed, it would give TI a body of computer assisted instruction more comprehensive than any other home computer. The tinsel-town lights shown bright on TI those 4 days. A joke went around the CES that TI was losing money on every computer they sold, but was making it up in volume. Even Bill Cosby, the TI spokesman, joked about the rebates then in effect pointing out how easy it was to get people to buy a computer if you paid them $100 to do it. These were laughable, but not for long.

The lights began to dim for TI almost immediately after the show. Just as the decision to keep software development closed would ultimately be disastrous (it was already showing up as a bad decision - the VIC 20 with an open architecture had already passed the TI in software availability), their attempt to go with a "three-computer strategy" was doomed to failure. While the upper level computer was an excellent direction to pursue, the "TIMEX-level" machine was an uninformed one. The same month as the CES fantasy, Commodore announced the price of the VIC 20 was to be $139 and the C64, $400. Again, rather than sticking to their guns, pursuing a consumer education campaign to push the products' differences, Turner and TI elected to drop the 99/4A price to the same level. At that price, TI lost all profit margin; they were at the break even price. About the same time, the computer's transformer failed a Canadian safety test. TI pulled in all the old transformers (at a cost of $50 million) for replacement or fix. They didn't have to do it with the U.S. models but did. This single event effectively wiped out all profits from the previous quarter.

A "smoke screen" still showed TI computer production up in the first quarter. Why a "smoke-screen"? While actual SALES of the

99/4A were stabilized, the shipping of computers to more and more retail outlets keep production up. The computers were not selling at the same level, but the shelves were full! It was a mirage. a smoke-screen. Rather than cutting back production at this point, they continued at record levels. The grave site was being dug.

Commodore then dropped the price of the VIC 20 to $99 and, reportedly, leaked a rumour that they would drop the Commodore 64 to $99 by June [in short order, Commodore also announced a "rebate" of their own on their new Commodore 64 - they offered a $100 rebate on the C64 if their buyer sent in "any video game or computer, even if it doesn't work".

Few 99/4A's were sent in under this deal, but alot of Timex-Sinclair's were bought at $50 and sent new to CBM for the $100 rebate - and a lot of C64's were sold]. The industry insiders had projected that the actual cost of making a VIC 20 was less than $60 and, while the Commodore 64 was introduced at $595, it could be sold profitably for $99. At $99, the VIC-20 was sold for less than the cost to build and market a /4A at that price, it usurped the TIMEX-SINCLAIR market in one fell swoop (T/S did try to fight by dropping the price on the ZX81 to $49, but failed dismally and stopped production shortly thereafter). Expensive R and D on the 99/2 (the lower level machine) and the "HEX-BUS" peripheral systems (which would allow use of compact printers, RS232 interfaces and high-speed wafer-tape storage with the 99/4A as well as the 99/2) were cancelled. The development of the 99/2, and its peripherals, was actually completed and marketing begun when the decision was made. With rising losses, production of the upper level 99/8 was also slowed.

In "The Home Computer Wars" (COMPUTE! Publications, Inc., 1984), Michael Tomczyk, former assistant to Commodore's Jack Tramiel, clearly alludes to the ironic if not poetic nature of the final result of the, predominantly, Texas Instruments versus Commodore "wars". He recalled the damage TI had done to Commodore and Tramiel in the "calculator wars" of the 1970's when, through price cuts, TI bankrupted many companies and almost fatally damaged Commodore. Now, in the "computer wars", the tables were turned. Tomczyk states "Texas Instruments had driven quite a few companies out of the business during the Calculator Wars...Now, less than 10 years later, Jack had turned the tables and was using TI's own techniques to defeat them - vertical integration, aggressive cost reductions, matching price cuts and more. TI insisted on cutting prices although they knew Commodore could match or beat them on cost." The adage "what goes around, comes around" was never more apt a phrase.

In the second quarter of 1983, the smoke screen cleared and the view was not a pretty one. Virtually ALL home computer war participants were losing money (they totalled one-half BILLION dollars; $183 million TI, $310 million Atari, and $24 million Mattel). TI disclosed it expected second quarter losses and sent its stock into a tailspin in which it lost more than $40 per share. TI's net income fell to $7.1 million (30 cents per share) compared to $27.7 million ($1.17 per share) in 1982. TI's picture was increasingly ugly. Machines from the thousands of retail outlets were showing up on their Lubbock doorstep returned and unsold. Turner had put the machines on the shelves "on consignment"...if they were unsold, they were returnable. The jig was up! The bar charts Turner kept influencing Bucy and Shepperd with had to be redrawn; specifically, the "SALES" bars had to be markedly lowered.

The Summer CES was a disaster. The much awaited "99/8" was not shown publicly (it was not a well kept secret and it was conspicuous by its absence; Turner had leaked those plans to "Home Furnishings Daily" in January) and, TI would not comment on why it failed to show the machine. TI further alienated the software industry by publishing a full-page ad in the June 4 (first day) CES trade paper which warned software producers of possible legal actions if they produced "unlicensed" module software for the 99/4A (see Appendix 1). (It should be noted the unique composition of the TI Solid-State Software [TM]. While other manufacturers used

plug-in cartridge programs, TI's cartridges were different. The usual module contained ROM - "read only memory" - chips and the program was simply dumped into existing memory locations in the computers memory chips.

Once in the computer's memory, it could be rather easily saved back out to disk or cassette, making copying, often for illegal distribution, a simple task. TI used both ROM and a new chip called GROM - "graphics read only memory" - inaccessible and uncopyable. While the method was effective against potential illegal copying, it was expensive method of making cartridges and made TI software relatively expensive. It was this GROM-based system that TI claimed as being copyright protected.) But the threat was taken as empty. ATARI demonstrated Pac-Man, Defender, Donkey Kong, Centipede, and Dig-Dug at their booth and promised 4 additional titles (Shamus, Protector, Picnic Paranoia and Slime) under a licensing agreement with Synapse. Thorn EMI announced three planned cartridge games for the 4A (River Rescue, Submarine Commander, and War Games). Parker Brothers were also rumoured to be planning a release for the machine. And in a true act of defiance, Michael Brouthers, President of FUNWARE (a small Texas Software house later acquired by Creative Software of California) walked up to the new TI machine, supposedly modified to detect non-licensed software (the version 2.2 OS) plugged in one of his cartridges and smiled as the game (Ambulance) ran perfectly. The press TI received in trade journals for its announced threats of legal action was entirely negative and, at times, hostile. Further, for a small firm like FUNWARE to be so blatant in its challenge to TI in the home computer software marketplace was a clear symbol that TI's power and status had slipped to a new low. And as if all that were not bad enough, Commodore cut the dealer price on the C64 to $200 (not the rumoured $99), announced 70 new software programs for their machines (exhibited on a 300 foot boat anchored alongside a pier a short distance from McCormack Place, the CES site...gaudy but very effective) and also announced they were cutting software prices in half on virtually all their existing programs. It was not a good show at all.

After the Chicago show, the new (factual) figures were presented to corporate headquarters, and the axe fell swiftly. Bynum had already been replaced in May supposedly in a "it's Bynum or me" ultimatum from Turner. Their disagreements had become legend in Lubbock. Bynum didn't agree with the software greed of TI and said he lost the battle with Bill Turner who he fought over that issue. Bynum said "Bill Turner is absolutely the best salesman I have ever dealt with and he sold that batch of snake oil to the Board". The final straw according to Bynum had occurred when Turner recommended dropping the price of the 99/4A to match the $99 VIC 20 price tag in early 1983 and Bynum said "The management of the Consumer Products Group and I parted ways in a fairly violent fashion. Because they said 'Jesus, we gotta get down to 99 dollars right now' and I said 'there is no way in hell you are going to get a 99/4A down to $99. It's more machine than the VIC 20 and costs more to build.' But that didn't stick; TI wouldn't let Commodore have their fire sale." Bynum was "promoted" back to the Corporate Research and Development Division in Dallas; he left TI, quite bitter in November. He later stated "I left because I didn't like the direction they were headed in. Needless to say, TI flew their business into the ground." (Further, he admits that he had been "functionally parked" in a personally lucrative but dead end job in Dallas and was "wasting the company's money. I had seen others treated like this and promised myself that, if it ever happened to me, I would quit". And he did). Herb Shanzer, former head of TI's calculator and Portable Computer program was Bynum's replacement. Then, Turner, the last survivor, was replaced and subsequently left TI to take a position with Automated Data Processing in New Jersey. Jerry Junkins, an executive vice-president (and head of the Data Systems Group which developed and marketed the TI Professional Computer) headed the consumer products division. His job, clearly, was to minimize losses and get out of the market as gracefully as possible. It had become an economic disaster and a corporate

embarrassment. TI moved the administrative wing of the Consumer Products Division back from Lubbock to Dallas to maintain a closer hand on the reins, and, in turn, President Fred Bucy established an office at the Lubbock facility of the Consumer Products Group.

Junkins made the smart choices. Bill Cosby was replaced as the media figurehead (after all, how could Cosby compete with Commodore's William Shatner, of Captain Kirk/Starship Enterprise fame?), hired a Hollywood advertising firm (Rogers and Cowan's Corporate Division which already handled Ford, R.J. Reynolds and Guicci) to direct marketing, and toned down advertisements showed kids learning at home with the parents (a direction Commodore had taken quite successfully). Rogers and Cowan targeted the "Matt Houston" series for TI ads which were planned to appear in every episode. He dropped the price to $99 (matching the VIC 20) to clear back inventory. He shut down production drastically. Further cost cutbacks were made (the black and silver metal casing was replaced on consumer preference) to try to re-achieve a profit margin at $100 retail sale. He bundled the peripherals and dropped their prices (previously, the Peripheral Expansion Box, Disk Controller card, Disk Drive, and Memory Expansion card had a suggested retail price of $1200; it was cut to $550 as a bundled buy; even free software was thrown in, the choice of a word processor, spreadsheet or Logo). Other popular software dropped substantially in suggested retail price. The big third-party software producers were brought under contract (Sierra-On-Line with "Jawbreaker", SPINNAKER with "Facemaker" and "Story Machine", SEGA with "Congo Bongo", Star Trek", "Buck Rogers:Planet of Zoom", IMAGIC with "Demon Attack", "Microsurgeon", "Fathom", "Wing War", and "Moonsweeper"). One bizarre move from Lubbock was to announce that the Consumer Group "would be represented at 15 state fairs countrywide" that summer and fall with "exhibits featuring the TI-99/4A Home Computer". TI stated in the news release (and probably quite correctly) that "TI is believed to be the first home computer manufacturer to participate in state fairs on a national level". The planned fairs ranged from Los Angeles to New York, from Wisconsin to Louisiana. Any port in a storm...

Though based on sound marketing logic, Junkins' efforts were too late. With the market place moving ahead to larger and more powerful machines (the Commodore 64, Atari, and others) (C64 and Atari more powerful? Never! R.T.), the sales of the VIC 20 and 99/4A alike were dismal. That market was drying up. Industry surveys began to show that the "new start" computer buyers were dropping; "second buyers" were on the upswing and you did not buy a 99/4A or a VIC 20 as a second or upgrade computer! In the second quarter of 1983, TI had corporate losses of $119 million. The Wall Street Journal of June 13 reflected: "Texas Instruments' tailspin could be an early sign that home computer makers have begun to glut the lower end of the market and that price cutting has begun to glut the lower end of the market and that price cutting has begun to take its toll." On August 26, it was announced that Peter Field would become the new President of TI's Consumer Group, Dallas. Field was a marketing specialist with Proctor and Gamble and headed their coffee division. He was, obviously brought in for his sales expertise, but the milk had long since been spilled and had even soured by this time.

A still unexplainable option was never pursued. The 99/8 would probably have a good chance to survive. First, it would have been a compatible upgrade for the 99/4A owners, and, second, as a solid machine, could have drawn in users on its own. But, faced with the Commodore 64's already solid foothold, the introduction of the Coleco ADAM with bundled peripherals (unpredictably ill-fated at the time), the rumours of Apple and even IBM venturing into the upper level home computer market, Bucy backed down on introducing the 99/8. Once bitten, twice shy holds truth in Texas. The torrid affair of TI and home computers was over. (After they had given us the best, most powerful home computer ever created. R.T.)

Chapter 2 - When The Smoke Cleared

Gary Kaplan, the often controversial Publisher of the Home Computer Magazine, spoke of the TI pull our poetically:

"It was the worst of times for Texas Instruments to exit the consumer computer marketplace: Their home Computer was, at last, positioned correctly; an extremely visible, no nonsense TV campaign presaged strong holiday sales; dozens of the industries finest software titles had been "cherry-picked." converted, and scheduled for pre Christmas release; and a new generation of powerful, upwardly compatible hardware was about to be launched. Ironically, it was the best of times that is, the best of times for hundreds of thousands of holiday shoppers looking for quality, affordable gifts or virtually no risk tickets to the intriguing world of home computing." [Home Computer Magazine, Volume 4:1, p.5]

Many TI owners remember where and when they got the news of the "pull out". It is akin to remembering similar circumstances surrounding major events of national importance. (It is an event that is a loss to the planet, that is equal, if not more important, than the assassination of John Fitzgerald Kennedy. R.T.)

I recall watching TV with the kids about ten o'clock and getting a call from a local user group member. He asked if I had heard THE news. After asking "what news?", my stomach assumed an equal measure of nausea and cramps. I had just sunk close to $1000 into my system for the PEB and cards and printer TI had marked down to bargain prices (now we all know why!). After regaining ability to speak, I told the caller "I have to go!" and hung up. I frantically called my local dealer, half believing he knew what was coming 2 months ago when I spent all that money. After all, he WAS a TI dealer! Line busy... and stayed busy for the next hour or so. I thought the worse; the line was off the hook because the dealer had skipped town. Then I got through. The dealer said, "No sweat. We'll stick with this machine and its product for a long time". But, he added, "if you want any software, you better buy it now. I am swamped with customers and they are buying me out!". He quickly hung up. I tried to think. What programs do I really need? None came to mind, but I better get down there just to look them over again. Before I left the house, I went to my computer and tentatively turned it on, fearing that diabolical TI had implanted a self-destruct device in the computer set to go off at their command. And Now was that time! (You get the same feeling when the warranty runs out on any expensive piece of equipment; at least I do). The machine powered up fine and I loaded a program or two (would they destruct all the software instead... going up in smoke like the files from MISSION IMPOSSIBLE?). The cartridges and disks ran flawlessly. Then I jumped in the car and headed to the dealer.

There is something about the human animal that seeks the company of fellow sufferers in time of fear and anxiety. The dealer's shop was a mass of familiar faces. All TI owners and all with a peculiar sick feeling on their faces. They were grabbing up, at least appearing in a haphazard fashion, every cartridge they could see and lay hands on. They were not reduced much in price from the day before, but today these buyers "needed" the software. Did they really need them, or even want them? Of course not. They were feeding their free floating anxiety about the TI announcement with something to reaffirm their hope that the machine would continue to function and be productive. In the far reaches of their mind, they all knew that the same software would be available months (years?) from that day at MUCH cheaper prices, but it didn't matter. That day, they needed security. The dealer loved that day (2 weeks later, he had marked down the same products more than half). He was assured that a TI market still existed; the consumers were reassured there were still products available in quantity for their machines; and I was reassured that I was not alone in my anxiety attack!

The president of one of the largest 99/4A Users Groups, the Washington D.C. group, Jim Horn, recalls colourfully his "Black Friday":

"It is easy for me to recollect where I was when the announcement occurred. I was standing in a twelve by fourteen foot booth with a twelve foot iridescent sign, proudly printed in "computer style" letters, saying TEXAS INSTRUMENTS COMPUTER USER GROUP. It had taken considerable effort to get there, along with those who were with me. We had found a computer show promoter, who in this case was promoting the Mid-Atlantic Computer Show, in Washington D.C. The promoter offered us discounted space, since we were a non profit group."

"The announcement, given on a Friday afternoon in Late October after the stock market had closed, instantly transformed what had been a triumph for our group into a wake. One felt like we were standing with a collective sign draped around our neck, which proclaimed "sucker!". The announcement, made late in the afternoon, was not picked up by the general press until the computer show was closing for the night. Nevertheless, all the officers in the computer club were flooded by calls into the early morning asking for more information, for reassurance. Information we had none. Several months earlier, in an effort to spike rumours of TI closing out the 99/4A option, a personal letter was mailed to every known TI user group, pledging that TI had a long term commitment to the home computer, or so it seemed. The letter was signed by the TI "User Group Coordinator," who, we learned within a few days, had already lost his job by the time the announcement to abandon the home computer market was made."

"One of the first things I did, upon reaching home that night, was to grab for a copy of that letter. Oddly enough, on rereading the letter, I could find no direct promise from TI to do ANYTHING, much less support the 99/4A. Allusions were made to commitments, such as "would we pull out, when we just..." were asked of the reader. The answers, if they were printed at all in the letter, were far from straightforward." Listening to other owners recall their "day afters" confirms similar scenes across the country. The PANIC had begun.

TI magnanimously stood by the owners at this critical time. It was almost as if they had a large burden lifted off their shoulders when they finally threw in the towel. In interviews and press releases, their principle spokesman, Jon Campbell (Manager, Press Relations) stated "We would like to exit this portion of the business as rapidly as we can and still maintain a high degree of credibility among our over 2 million 99/4A owners", further that TI would continue to support the 99/4A "on an indefinite basis". He cited TI's exemplary service policies regarding other discontinued items, such as watches and calculators. Indeed, TI continued to manufacture consoles into early 1984 to fulfill "contractual arrangements" and to have a stock available for the service and exchange centers. They manned the TI toll free information number (appropriately 1-800-TI-CARES) with additional personnel to handle the massive influx of calls. It even appeared that TI wanted to assure the owners that there would be continued software available for their machines. On January 9, 1984 Texas Instruments announced the signing of Walt Disney, Sierra-On-Line, and Imagic to produce their existing software for the 99/4A. Dale Osborne of TI stated that the agreement was "part of our plan to provide alternative sources of quality software for owners of the TI-99/4A Home Computer. This is part of TI's commitment to its consumers to take steps to provide continued support...". TI also announced that it would issue licenses for its auto-incrementing GROM chips to third-party producers. Obviously, a total reversal of the policy pursued at the previous summer's CES.

At this point of the game TI stood upright and performed well in maintaining consumer contact and reassuring a rather irritated mob of owners.

And a lot of reassurance was needed. After the initial anger of being "dumped" wore off, and the cursing abated, fear set in. It was a reasonable emotion. Looking at it in perspective, TI's withdrawal was of more impact than the withdrawal of other computer manufacturers. Why? With TI's closed machine architecture, TI had successfully cornered the entire market for software and particularly hardware for their

computer. It was a monopoly of complete control. Other computer manufacturers producing both hardware and software for the machines almost coincident with their market entry. Consumers of these machines can pick and choose their peripherals from many choices and if "orphaned", will still have standing support from other producers to curb their anxieties. With the TI owners, there was virtually no other support. The September 1983 issue of the (then) 99er Home Computer Magazine had a supplement called "99er Directory" which listed all the available software and peripherals. It was an impressive 21 pages long and listed some 160 or so producers. But when analyzed more closely, it is less impressive. The vast majority of the software was cassette based and in slow BASIC or at best, EXTENDED BASIC. Virtually NO machine language code existed in the third-party sector; the limited architectural information available from secretive TI made full and efficient utilization of the speed of the machine code near impossible outside TI. For instance, of the 19 "word-processor" listing only one was actually in Assembly Language (the closest thing to machine code and essentially as fast). Of the myriad games, fully less than 10 per cent were in assembly language. That is not to say the others were not good; it is to say that they were much slower than TI's arcade games. In hardware, there were two manufacturers at least advertising 32K memory expansion cards for the Peripheral Expansion Box (Foundation in California and ULTRACOMP in Illinois), and another company producing "stand alone" memory expansion modules which did not use the PEB and just plugged into the console itself (Doryt Systems of New York). One manufacturer was fighting TI's threat against companies producing cartridge based software for the 99/4A and put out several well done games (ROMOX), but that was all there was beyond TI. The point remains that the TI user was in a very dependent position with Texas Instruments. Sure, they had a few scattered hardware producers, none very successful, and myriad software producers of rather simplistic code. But when it came to truly useful and fast games and productivity software and hardware, TI was it. This simple fact added amplitude to the anxiety of abandonment. With TI's announcement, the initial feelings of doom and gloom were certainly understandable.

The TI owners were abruptly faced with a major decision. They had to decide whether to consider their purchase a mistake, minimize their losses, and sell their equipment for what they could get and, if they really needed a computer, take advantage of the upcoming Christmas sales and buy a new machine OR stick with their purchase of the TI-99/4A as a good machine, pray for future supporting product development, and buy TI for the holidays. It was, at best, a difficult decision to make. Most TI enthusiasts stuck with the machine, banking with the faith that third-party producers would step in and take advantage of the estimated 3 million machines sold. Some even thought that this was merely a marketing ploy by TI to clear inventory prior to release of the 99/8 upgrade computer. After the 99/4A was sold out, even at moderate loss, they would have massively increased their installed user base, set the hook for more in the market for an upgrade, and, then, in the slickest move since John Connely "became a Republican", they would return to the scene with the 64K machine and sell millions more. (This thought was shared by several industry analysts who believed that the corporation's "cautious" exit from the market indicated a desire to slip back in later. They noted the protective handling of TI's distribution network, and even continued support sales of the discontinued 99/4A through the Christmas season with at least half of the company's pre-purchased TV ad time). Whatever the reason, the vast majority of TI owners chose to stay with that market after the crash, and the buying and selling began.

The panic buying, fuelled by the fear of not getting any more decent software and hardware was accompanied by a full measure of "panic-selling". Here we had buyers willing to buy most anything remotely TI, whether they needed it or not, and we had dealers and retail chain stores trying to wash their storerooms of TI stock as fast as they could for the upcoming Christmas selling season. The sellers didn't want to take up valuable holiday shelf space with a no longer

manufactured machine. They wanted to stock the Commodore's and Atari's which would be the big item in computers that year. So prices fell out of the bottom.

The sellouts were a sight to behold. Rivalled only for the crunch to buy Cabbage Patch dolls the following year, when a J.C. Penny's or Sears or Montgomery Wards sold out TI, the buyers were lined up before the doors opened. While no physical violence was reported, it was a scurry for the consoles (going for as low as $50) and other peripherals. Some stores had to set limits on the number of computers sold per customer. Needless to say, stocks were easily sold out. Quickly and efficiently.

It has been estimated that 150,000 99/4A Home Computers were sold in the last two months of 1983 alone. Retailers sent orders to Dallas for at least 200,000 machines the Monday after its pullout announcement. The cut-rate prices outweighed the prospect of no future manufacturer support and to these new buyers TI's misfortune was an ideal way to enter the home computer movement at almost no financial risk. The smart buyers felt they could spend $50 on a TI and, after using the computer for a time, if they were comfortable with computers, they could buy another supported machine and move on. It was really the first time buyers that had the chance to see if these modern marvels were for them without spending a lot of money for a "trial run". The virtual no risk opportunity was, apparently very attractive for many holiday buyers.

But all were not first time buyers. There were those who were convinced that their TI-99/4A was at purchase AND post abandonment a wise purchase. After all, it was the only 16-bit machine in the home computer market, its educational software was excellent (particularly, the solid-state cartridge design of the modules made it easy for young children to use the computer), its speech capabilities were the industry's leader, it had capability to be programmed in virtually all available languages (though never released commercially, the 4A had been demo'ed running PILOT and FORTH as well as sold LOGO, UCSD Pascal, BASIC, Extended BASIC, Assembly Language, and CP/M - the last from a third-party firm), and it was a well built, reliable machine. Further, TI was a major innovator in home telecommunications; they with Source Telecomputing corporation organized as a special section or The Source strictly for 99/4A owners called TEXNET. The TEXNET sub-network supports the unique sound/graphics/speech capability of the 99/4A computer and its emulator software. A program library of free programs was also maintained specifically for the TI user. In addition to that, a certain pride exists with computer owners. They will never agree that another machine is better than their's. It is as true now as it was then. The TI owners were not about to give up the ship. They went out and stocked up for the coming drought. Second (and third, and fourth...) computers were whisked up with a smile. Repeat 4A purchases were probably as prevalent as first time sales. Like gathering fire wood for the seasonal chill, the abandonment brought out the pack rat in all 99'ers. They knew they had to stockpile, and they did. For them, it would be a frigid winter.

The massive sellouts and associated expansion of the 99/4A owner base was both a temptation and a frustration to third-party hardware and software producers. On the one hand, here was a consumer market estimated to be 2-3 million strong, industry abandoned and eager to spend dollars to maintain their purchase's utility. On the other, mass retailing outlets were liquidating their TI stocks and would, in all likelihood, no longer carry 99/4A-related software and peripherals. Thus, the buyer base was there but how to market was the problem. The solution could only be mail-order and mass advertising. A few would be successful in the transition. Many others would not.

On December 20, 1983, Texas Instruments announced a preliminary agreement with March Direct Marketing (MDM), a wholly owned subsidiary of McCann-Erickson, to provide access to TI's list of 99/4A Home Computer owners to third parties interested in this user

base. This was to make available a way for TI to liquidate their remaining stocks while following legal guidelines restricting them from selling the software and hardware out of TI themselves. Also, superficially, it would make available the mailing list to third party product developers, though the sheer cost of the list in the final tally proved much too expensive for anyone but the largest distributors to obtain.

On March 28, 1984, TI stated they were finally completely out of the business of selling their remaining stock of 99/4A materials. Due to agreements with the Federal Government, TI received certain tax incentives after leaving the market on the condition that they cease direct sales of their software and hardware. With their grace period running out and in the face of building pressure from the Securities and Exchange Commission to clearly and with finality, stop the production and sales of 99/4A materials, the remaining stock had to be turned over to an independent seller for final disposal. Remaining programs and equipment were to be cleared through an "organization separate from Texas Instruments". The company would be Triton of San Francisco, a "well established direct response/mail order firm" which, according to Triton spokesman Terry Miller had experience in marketing business products and software, but had never been associated with TI. The transition would take effect on March 31. Triton would be the sole source for clearing remaining 99/4A inventories (save those the commercial distributors had in stock) and would publish quarterly catalogs which would carry TI and third-party materials for the 99/4A machine. The first catalog from Triton appeared in early May. It was a well done, color catalog with the creative work coming from March Direct Marketing. In the announcement of the turnover to Triton, TI mailed to users groups a list of the third-party hardware producers for the 4A and the mail-order distributors. The curtain came down with authority. No more hardware and no more software were to be produced or distributed for the 99/4A by Texas Instruments. They would retain on hand only those materials they would require to support their warranty and repair services to the sold machines. They continued to operate the "TI Cares" phonelines, but this was more a commitment to the purchasers of active, production equipment than for Home Computer owners. It was, truly, a goodbye from TI to the users of the Home Computer.

Several questions remained as the door closed in Dallas: why the October announcement? One month into the final quarter preceding, surely, the most intense computer buying season in history and TI bails-out. Why not after the season? Say it was not successful and then quit? Egil Future Computing, Inc., stated "my feeling is that they would have had a good Christmas season [if they had stayed in home computers]". One must give the Texas Instruments hierarchy their due. They did not want to mislead the Christmas buyer into believing that TI would be around. They did not sit pat and draw unsuspecting new buyers into the market. They laid their cards on the table. Of course, they would get the "curious" and the repeat buyers with fire sale prices after abandonment, but they also showed corporate class by announcing when they did. With that knowledge buyers entered the season with a clear view of where they stood and were the 99/4A stood. It was a difficult decision to make and Texas Instruments made the right one. (Or did they? This will have put hundreds of people off of buying a 4A who will have gone out and bought a C64 or Atari, and where are they today, compared to where they might have been if they had bought a 4A!?!?!? R.T.). An article in Business Week magazine (November 14, 1983) quoted a philosophical Bucy as saying "Our 99/4A business did pick up, but not at a sufficient rate. It was a bitter pill to swallow. But how much blood can you lose?" Bucy went on to state the bottom line: "this is the best time to move inventory - not after year end."

Did TI make a mistake by moving the production of the computer from the Dallas home base to Lubbock? Fortune magazine in their November 28, 1983 issue cited, from a "former TI executive", the move as one of a number of "poor management decisions" that brought about the computer failure. Fortune observed that it was difficult to attract young "hotshots" to the

Texas Panhandle city, and some transferred engineers refused to move from Dallas. No one admits to the responsibility for the decision (it is suspected that Fred Bucy, from that area may have been the one) but another former TI executive (there are alot of these running around) explained it his way: "Texas Instruments had always had a history of locating manufacturing in agrarian economic areas. They believed workers recruited from that type of local work environment work harder and are more dedicated. But in Lubbock it sure made recruiting tough. Invariably, you could predict a heavy dust storm whenever a hot, new recruit arrived for a tour. It was a genuine problem." What effect the move had on the quality of engineer support for new product development must remain speculative, but the failure to develop innovative peripherals and software failed to entice enough first time buyers in the TI market.

Fortune magazine further noted, in a bit of irony, that one of TI's failures was over compensating to resolve a past fault. They stated that "the company misjudged demand. In the past, TI has been chided for not listening to customers - especially about consumer products. This time, top managers were so determined to listen that they took as gospel their dealers; too-rosy forecasts. The result: a disastrous build up in inventories." TI was certainly not alone in over estimating. The entire span of forecasts from virtually all camps on the home computer market have proven to be grossly inaccurate.

Two final footnotes. Once TI dumped the home computer market, they certainly didn't take long to again become a profitable corporation. Wall Street responded to TI's abandonment of the home computer marketplace on the first day after the October 28 announcement by boosting TI stock an astounding 22.75 points, from $22.75 to $124.50. The company announced first quarter profits for 1984 of $79.8 million. For the same period in 1983, profits were $7.1 million. Profits yielded a $3.32 per share compared to only 34 cents in 1983. Sales were up from $1.17 billion in first quarter 1983 to 1.34 billion for the same period in 1984. A major part of the profits were 41 cents per share from the write off of home computer stocks.

Second, a feature from News American Syndicate (which gives Future Computing as the source), and seen in the Pheonix Sun newspaper in August of 1985, showed a graphic of the "existing home computers in 1985" as percent of total owned. The leader was Commodore with 30%; second was Texas Instruments at 22%, ahead of Apple, Atari, Tandy, and IBM. Nearly two years after they were out of production, the 99/4A remained a major force in the installed home computer user base. How have these users survived? There lies the most interesting part of the story.

Chapter 3 - Commercial Users Groups

In the first issue of Texas Instruments' User's Newsletter, which listed their "recognized" users groups was the first news of a group called the "99/4 Home Computer Users-Group" organized by one Charles LaFara. The tale of Charles LaFara and his "users' group" is certainly one of the most embroidered chapters in the history of the 99/4 and 4A Home Computers and their users. The organization was never a "users group" in the sense that there were meetings and local assistance. It was a profit making business. The distinction was never clearly made by TI or Charles LaFara until the confusion of what a user group was supposed to be was strongly ingrained in the minds of the 99/4A owners. That confusion even exists today.

Charles LaFara was a well travelled man, married and with children who was President of the Southwest Meat Company in Oklahoma City, Oklahoma. He bought his first 99/4 in March, 1980. Being one of the first owners of the 99/4 he faced a shortage of programs and sought a way to remedy the problem. He tells the story thus:

"Faced with either abandoning a product which had cost me over $1000 (console and monitor) or taking the initiative and doing something about it, I chose the latter. As an outside individual it was extremely difficult to interface with a company the size of Texas Instruments

Incorporated. Disgruntled and frustrated, I almost gave up until I met a gentleman in Baltimore, MD, Joe Nichols, who suggested that together, we form some type of Users Organization for owners of the 99/4 Home Computer. [Joe Nichols later died, reportedly of a heart attack in 1982]

After many months of conversation with Texas Instruments' legal department and corporate executives, we were finally granted permission to do a mailing announcing our intentions of forming a Users-Group to 1,492 known owners of the 99/4. In the beginning, it was our intention to conduct this as a very informal group, sharing information and our own programs among ourselves. In order to limit any personal liability, we incorporated in the state of Oklahoma in September, 1980.

The initial plan, according to LaFara, was that he would do the "marketing" of the idea, and Nichols would provide "the seeds" for the library by writing and translating programs for distribution. LaFara admits that he was "no programmer". Nichols, in fact, did provide the Home Computer Users-Group with its first 8-10 programs. The basis of the software library, thus formed, it was time for LaFara to begin his "marketing".

The gregarious and persuasive (and if there IS a descriptive term for Mr. LaFara, it is persuasive) LaFara though persistence did "interface" himself with TI and became well publicized by them. The mail out described in the above passage was from TI's own mailing list. The response by users who received the announcement was totally positive; of the 1,492 flyers mailed out, over 900 responses were received. In the previously mentioned issue of the User's Newsletter from TI, the LaFara founded 99/4 Home Computer Users-Group received a half front page announcement. The announcement did mention that the Users-Group was "not affiliated with Texas Instruments". TI's announcement spoke of LaFara's operation in almost pioneer, sacrificing terms:

"The 99/4 Users-Group has become a family hobby for the LaFaras. Family members share answering the phone, replying to letters, copying programs on cassette and diskette, and evaluating new user programs. The living room of the LaFara home is outfitted with two TI-99/4 computers and monitors, one 80-column printer, four disk drives, three cassette recorders, an RS232 interface, a SOLID STATE SPEECH synthesizer, modem, and joysticks."

The TI article also mentioned that "no dues are charged". That changed soon after. Effectively May 1, 1982, payment of $12 for annual dues was charged. Those dues entitled the members to a bimonthly newsletter, discounted prices on TI products, and access to a "software exchange library". The software library was an interesting concept LaFara put forth. It operated like this. You could get "public-domain" programs from the library through one of two means. By submitting a program that you wrote that was acceptable to the library (virtually ALL submitted were accepted), you were entitled to get 4 programs of your choice from the Users-Group catalog. If you were not a programmer, you could purchase a program (minimum of 4/order) for $3 each. Here is where the problems started. In the entire other worlds of Home Computers, very few had tried such a thing, that is, selling public-domain programs piecemeal. Those who did try, were generally shunned and boycotted "The rules, though unwritten, were generally accepted to be that it was legitimate to distribute public-domain software for a copying fee per diskfull or by size (for example, a fee for each 100 kilobytes of program space)." But the "rules" strictly forbid putting a price on individual programs NO MATTER HOW LOW THAT PRICE MAY APPEAR. To do so would negate the very principle of Public Domain. You can find ads for various disks full of CP/M software, etc., but virtually none to buy single Public-Domain programs. Charlie dared to go against the grain and succeeded simply because of the generally new-to-the-computer-world TI user. It is a strange legacy left to us in that even non profit local users groups across the country today STILL request a fee PER PROGRAM in distributing Public-Domain software to their

memberships. Certainly, they generate monies for newsletter expenses and not officer's salaries, but the traces of commercialism remain.

The controversy continues when one read the IUG catalog's "COPY RIGHT STATEMENT" (Appendix 3). The statement was one of the most convoluted legal statements of record. What it said was, in essence, that the International 99/4 Users-Group (the name change was first used in the October 23, 1981, Volume 1, Number 7 newsletter from the Users-Group) or IUG did not hold copyright THEMSELVES on any of the "public-domain" programs and, thus, had no liability for the workability or quality of the programs. The IUG would not touch the source code of any program. On the other hand, no one else may copy or sell these programs without the written consent of the author of the programs. These authors, almost universally, were not interested in copyrighting their programs but, whether they liked it or not, submission to the IUG library MADE them copyrighted. One copyright attorney rendered an opinion of IUG's document. He stated that it is not legally possible for any third-party to "impose" a copyright on an author. Only the author may claim it. Further, turning a copy of a program over to someone for distribution does not of itself constitute the release of ownership of ownership of the program to another unless there is a specific release made in a written contract or statement. Thus, placing a program or work in the public domain does not cause the author to lose his creative authorship copyright. It causes him to lose ownership and control of that program's distribution and use. Consequently, the author retains the copyright which cannot be acted upon (in a legal sense) and loses all ownership of it. Thus, LaFara was incapable of claiming any exclusivity with programs because he claimed that he was protecting the rights of the author although, in fact, he was trying to protect his profits from the use by others of the programs. The bottom line appears to be that the submission agreement, quite simply, a legal smoke screen that IUG would use to its detriment in the end.

No dues were charged but expansion and expenses were incurred as the operation grew. Income was generated from several sources, primarily as a mail-order order house for TI products and from sales of public-domain software submitted to the users-group. One neat money raiser was a contest held by the IUG in early 1981. Winners were declared in the 3 pre-designated contest categories and the winners got a new Extended BASIC module as the prize. Then, the IUG (still Home Computer Users-Group) sold a cassette tape of the best programs for $20 each. Office space was acquired in Oklahoma City in March, 1981 and two full-time employees were announced (it should be noted that one close former IUG-insider states, adamantly, that the two "employees" were LaFara's wife and their son, and the announcement was made to make the appearance of growing importance and strength). According to the User-Groups estimates, they were shipping 4000 program requests per month. LaFara, with his almost monthly pilgrimages to Lubbock, Texas, had secured the support of Texas Instruments and, particularly, Don Bynum. When TI formulated plans for the innovative TEXNET database on the Source, LaFara was given the job of supplying the program library for free downloading to subscribers. He made a living.

Another point demands to be made. The policies and commercialism of the International Users Group forced, in the eyes of one close industry observer, the coinage of the term "commercial users group". Based on previous standards, it was an "unintentional oxymoron", a gross conflict of terms. It appears that in literature that refers to support of the TI-99/4A, you will find the term mentioned almost exclusively in that community. While commonplace in the 99/4A support world, "commercial users groups" are rare if found at all in the other computer's literature. LaFara had created a new entity that was so simplistic and profitable that it was very appealing to other entrepeneurs (as LaFara likes to be called). "Commercial users groups", if they continue to exist, can be traced almost directly to LaFara and the IUG. Copy cat companies began to spring up all over the country. One of which,

would have to be dealt with later legally by the IUG.

The IUG grew rapidly in size and influence. In October of 1981, the IUG newsletter declared 7000 members in 19 countries. The user-written software library had swelled to 500 programs. Perhaps because of the general naivety of the home computer market, the transition from a users-group to a business was virtually unnoticed by the members. The starting of dues never reached the IUG newsletter, but in a "membership information" flyer, dues were $12 annually. For $50, you could get a "PRESIDENTS CLUB" membership which entitled you to additional discounts on purchases through the club. LaFara even took a poll as to whether the membership "wanted" the users-group to "serve as a supplier" for TI products. According to his reports, the response was overwhelmingly in favour of the users-group selling products. The die was cast. What had started as a users-group had become a big business.

LaFara was noted by some to play an interesting "triangle" affair between his commercial organization, the 99/4 user and Texas Instruments. By interfacing himself between the two, he served his own purposes by generating an air of artificial "self importance". He would make frequent visits to Lubbock, and talk his way into the inner circle there, making deals for TI information and, often, equipment. Then, he would go back to Oklahoma and write his newsletter about his inside information by printing "according to our sources within Texas Instruments..." or "representatives at TI have informed the Users-Group..." etc. It was a simple gambit but effective. By standing as an inside source for TI information, he would generate increased membership. Then, by displaying the membership numbers at Lubbock, he would appear quite formative in the consumer sector and, thus, appearing to be a major "free advertising" source for TI products. And the circle went on. No better statement of this ploy is evident than a comment appearing in the IUG newsletter of February 10, 1982 (Volume II, number 1). The rhetoric went like this:

"Our policy has been to report the facts to the 99/4 owner as quickly and as factual as possible. We have reported both the good and bad sides of products and services and have seen several changes made on behalf of the consumer due to our efforts. Many of these changes have resulted in better overall products being offered for the 99/4 and added to the enjoyment of personal computing for all 99/4 owners."

Nothing sinister in the statement certainly. But there is the "look what we can do for you" power showing through. That is how the game was played. And the IUG played it extremely well. They MADE themselves important by APPEARING important. They did receive early product release information from TI. They did beta test proposed TI software. And, with importance, came sales. Both TI products and their "public-domain" programs.

Perhaps the biggest fault with the IUG operation was the clouding of the definition of "public-domain" programs. Public-domain software are programs written and freely given to anyone who wants the program. There are no strings, no copyrights, no protection to prevent copying. Certainly, paying a service to cover distribution and reproduction costs in not unheard of. IUG charged for these services and that is perfectly understandable. Where IUG lost credibility with many users is the artificially imposed copyright scheme alluded to earlier. They IMPOSED a copyright on the software when it was submitted to the IUG library. They appointed themselves the enforcers of the implied copyright and, thus, confused the 99/4 computer user as to what the term public-domain meant. It was clear to the informed that IUG could legally charge fees ONLY for the service of getting programs out to the members who sent for them. NOT for the program themselves. But IUG pursued a line that the programs themselves were what they were selling and not the distribution costs. That is where the issue was distorted and, even today, the TI Home Computer users are generally unsure about what actually is public-domain software. IUG aggressively pursued this point with threats of legal action and, eventually, it

was their own policy that led to their loss of credibility in the 99/4 community and brought about their demise as a company.

It began after TI left the home computer marketplace. Stripped of his "inside track" to manufacturer information, LaFara was left with one major money producing asset: the IUG's library of nearly 2000 owner written programs. He became intensely protective of this remaining holding. In an article by LaFara in the September, 1983 Enthusiast magazine (Volume 1, No. 3), he made light of how aggressive he was to pursue the "copyright protection" of the IUG "public-domain" software library. He wrote:

"Can software piracy be stopped? Probably not. One of the newest methods to curb software piracy of copyrighted material is the placement of an invisible code between line numbers which cannot be seen by the user when the program is either listed to the screen or to a printer. This method has been put into practice by many software developers and is currently in use here at the International 99/4 Users-Group on all programs in the Software Exchange Library. Although the practice does not assure protection from unauthorized duplication of program, it does enable the manufacturer or copyright holder the ability to prove the program's origination."

There are many who are quite sure that IUG NEVER used such a protection scheme. Regardless of whether the "invisible codes" were instituted or not, the comments were the first salvo in LaFara's onslaught to guard his tenuous hold on public-domain software and its distribution rights. The IUG filed a suit against the "99/4A Program Exchange" of Torrance, California. This company undercut the IUG in several ways; they sold their programs for $2.00 each ($3.00 for IUG) and offered a five-for-one exchange for submitted programs (IUG offered 4 for 1). They also put out a newsletter. They were not the big operation that LaFara had, but they began to cut into the increasingly meagre IUG revenues. LaFara describes the "Program Exchange" as being run by a "17 year old kid who was a former IUG member. We refused to accept a couple of his programs for the [IUG] Software Library, so he started his own company to get back at us." IUG was successful in its suit, LaFara admits, not on the grounds that this company was selling public-domain software. That was not a legal point. Public-domain was not copyright protected. The suit was won because the IUG proved, rightly, that the California company was using IUG printed catalogues and program descriptions in mail distribution and advertising. Additionally, the Torrance company was guilty of using a company logo which was almost identical to the registered trademark of the IUG. Clearly, IUG was on solid legal grounds and correct in pursuing the case. Where IUG was wrong was in depicting the case as one of successfully suing and winning on the grounds of infringement and sale of copyrighted programs. The distinction was obviously not made in LaFara's statement when the suit was announced in ENTHUSIAST 99, a publication of LaPUBCO (LaFara's publication company) in its March, 1984 issue (Volume 2, Number 2) Charlie LaFara, IUG president said:

"....after consultation with our attorneys, we feel very strongly that our rights have been violated. Unauthorised use of programs and descriptions in our Software Exchange Libraries as well as infringement of our corporate logo must be dealt with."

What IUG appeared to project to others is that they were suing for sale of programs. What they really sued for and, rightly so, won an out-of-court settlement for use by the Torrance company of copyrightable printed IUG catalogs and program descriptions. NOT for the sale of the programs themselves which, quite clearly, could not be sued for. It was a tactic to prevent others from distributing "their" programs. Successful once, LaFara made a fatal mistake when he sent a letter to a large, non profit users group in Atlanta, Georgia threatening legal action against that users group if they continued to distribute public-domain programs from the IUG library. It was the resulting backlash of unfavourable response by other local users

groups that severely cut into IUG membership roles, program requests and equipment sales. LaFara's position was that the Atlanta users-group was distributing in their non profit library CERTAIN programs whose copyrights WERE held by employees of the IUG; thus, the programs in question were in the IUG Software Catalogue, they were not the usual owner submitted programs. HE stated "These WERE copyrighted programs and IUG held copyrights on several programs in our library." When chastised in the newsletter of the large and influential Los Angeles Users Group Newsletter, LaFara responded with a letter which contained the following statement:

"Regarding your 'sister group', the Atlanta 99/4A Users Group, we indeed have informed them that pending legal action against the group and its officers will be taken provided they do not respect products to which the IUG or employees hold legal copyrights." (Letter dated August 28,1984)

LaFara still dismisses the notion that the bad publicity his organisation received from the threatened legal action against non profit users-groups. He recalls, "the feedback we received from the vast majority of other users-groups was that they understood our position and supported us." He admitted, that actually pursuing a legal course was "fought by me completely", and that IUG used the legal language to "get results, which we did."

For the first year after TI's pullout, IUG did relatively well. Infused with new, uninformed buyers from the '83 "fire sales", they remained profitable. But then things suddenly changed. An attempt to work with Texas Instruments in moving their new TI Professional Computer at bargain basement prices (with the requirement that the buyers submit 5 user-written programs to IUG over the ensuing 2 years) failed. Letters were sent out by Texas Instruments' Software Development Program section included a letter on IUG stationary and signed by Charles LaFara, because TI did not deliver a promised conversion program to make 99/4 Home Computer programs runnable on the TI "PRO". That program would have made IUG's huge Software Library marketable for a successful upgrade computer. But it was not to be. Threatened and defensive, the IUG became increasingly isolated from both their former advocate, TI, and their consumers. In the end, IUG had alienated the 99/4 user and was losing money rapidly. $2000 per day became $200 per day. Finally, as LaFara puts it, "the faucet just turned off in November, 1984." The decline continued and, in early 1985, the announcement was made that IUG was filing for bankruptcy (see Appendix 2). From a company which, at one time, had 24 employees and 10,000 square feet of office space and, from LaFara himself, "had some $2000 income days", IUG was bankrupt. At the time of this writing, Charles LaFara, himself, was contemplating filing personal Chapter 7 proceedings. He and IUG are being sued by a former employee for, most ironically, "copyright infringement" to the tune of $1.5 million dollars. There are rumours of several complaints being lodged for everything from mail fraud to fraudulent business practices. It is not a pretty picture. LaFara is stoic in his response to the final outcome of his corporation. He commented, "we knew it was one of the risks you take when you become an entrepreneur." He is presently doing "consultant work" for a group of physicians. His biggest mistake? "Staying with it [the IUG] too long."

Started on a noble premise, IUG suffered mainly from grandiose ambitions. They, early on, provided a valuable service to the rather sparse and isolated 99/4 computer owner. They were so few in number that, in all but the larger cities, local users groups were virtually impossible to locate. The IUG served as a central clearing house of programs and information for these early TI Home Computer users. But as the owner base became increasingly large and local users groups more accessible, their importance began to wane. They even, offered two major resources local groups couldn't provide: first, an informed source of information about Texas Instruments and, two, a huge program library. Then, the first asset vanished in October, 1983. Attempts by IUG to strike a deal with TI to,

among other things, run TI's busy TI-CARES assistance line, were turned down. Then, after the pullout were ill-advised legal threats by, now, a company against legitimate, non profit local users groups, further accelerating their financial failure long before its time. Local users groups had usurped the IUG position in directing the 99/4 owners. Even LaFara admitted that "we knew all along that local users groups would become more important to users as time went on."

Chapter 4 - The Real Users Groups

User groups have always been the primary force in the home computer "movement". They first arose when computers came in kit form and, unless you were an electrical engineer (or, at least, very smooth with a soldering iron), those really wanting a computer needed help getting one together. Soon after Micro Instrumentation Telemetry Systems (much better known as "MITS") began selling the first popular computer kit (Ed Roberts' ALTAIR) in 1975, the first computer clubs ("HOMEBREW" in San Francisco, SCCS in Los Angeles, and ACGNJ in New Jersey) sprung up. (It should be observed that in Alfred Glossbrenner's book "How To Get Free Software", he quotes Sol Libres [professor of electronics at Union County College in New Jersey and computer pioneer] who recalls "The first computer club was founded in 1965. It was a national organisation called the American Computer Society, and it had as many as 250 members." But this was not a local-level group with frequent meetings.) Even though computers no longer come in kits, the lack of technical information about hardware and software has grown even larger (probably BECAUSE computers no longer come in kit form, people have even less of an idea of the inner workings of their machines much less how to repair or interface them). Users Groups have been popular since the beginning and have served as an indispensable information source for the computer owner, filling a gap the industry itself had neither the resources nor (understandably) the inclination to deal with.

The industry has always known this also. Ed Roberts knew it in 1976 when he filled a motor home - "The Blue Goose" - with MITS employees and sent it roving about the nation. The road show (which included Bill Gates, then a young Harvard undergraduate and a software designer at MITS) stopped from city to city and talked with both owners and potential owners as well. The computer manufacturers have encouraged user groups since. They in, turn, have brought more new owners to the fold than any advertising scheme. Equally important, by solving the technical problems of owners, they have KEPT computer owners using and expanding their machines rather than abandoning them in frustration. The often uncanny expertise of user group members has brought the home computer movement farther than any other single development. Alfred Glossbrenner, highly published author of several books on personal computers, estimates that there are over 1000 users groups in the country, ranging in size from 2 or 3 members the behemoths of memberships over 10,000.

Texas Instruments knew the importance of user groups too. Early in 1980, the corporation set up a position in the Consumer Products Division in Lubbock titled Users' Group Co-ordinator. They began publishing a bi monthly flyer for all registered TI computer owners called the User's Newsletter. There was a note that stated "TI is interested in assisting users who wish to form new users' groups in other areas of the country."

Almost ironic, the same issue of the TI Users Newsletter that introduced LaFara's national organisation (Feb/Mar 1981) also published the first listing of local, non profit users groups. Ten listings (Cincinatti, Denver, Eugene [Oregon], Houston, Los Angeles [2], Pittsburg, San Diego, San Francisco, and Washington, D.C.). From this meager list, local users groups were to grow in number to over 300 groups across the country. From the large cities to small towns, as the TI Home Computer was sold in increasing numbers, the users groups naturally followed.

Virtually all of the Users Newsletters had sections for new user groups being formed. TI quickly appointed a user group co-ordinator (Ed Weist) to handle correspondence and information

for this growing clan of potential customers. TI even developed an official, recognised list of users groups and laid out specific guidelines on how to become "official". You had to have 15 members and then contact the users' group co-ordinator in Lubbock. He would, in turn, send you a "Starting Kit" which consisted of a suggested constitution (with a large explicit explanation on how groups should handle copyrighted programs), bylaws, preliminary organisational guidelines, agendas for the first three meetings, committee responsibilities, steps in setting up a newsletter, and a listing of the recognised local groups. After a group met three times and verified same to TI, they became "certified". TI obviously took users groups quite seriously. Other than the Starting Kit, you received little else from TI save an occasional letter from the co-ordinator with a product announcement or such and, perhaps, an occasional disk of public-domain software, but these were few and far between. There was one offer by TI that was a major concession from the Texas firm. An early offer was the Notice Mail out Program. This amounted to a one time offer to a "recognised" TI-99/4A user group to have TI use its massive mailing list of owners to mail out, free of charge, a meeting announcement for the group to all users on TI's mailing list in that group's area. In mid-1983, TI announced it was dropping the notice mail out offer (due to "many factors") and initiating an offer to provide recognised users groups with up to $200.00 of local advertising moneys for meeting dates and public visibility. The groups sent a copy of the proposed ad for approval prior to submitting to the media. Once TI approved the ad and it was run, the group forwarded an actual copy of the ad along with the bill. TI, then, would pay for the cost up to the $200 ceiling. The restriction was that the ad could only announce meetings not sell products. It was a one time offer to individual groups but a good way to get publicity. If the group had used its notice mail out program, they were ineligible for the ad reimbursement. User groups flocked to become official.

From 10 in February, 1981 to 24 in November, 1981 to international groups in January, 1982 (Germany, Australia, and England being announced) to 35 in June, 1982, the list rapidly grew. The October, 1981 issue of the Users' Newsletter had a long report of TI using one of its largest groups as a launching pad for several new products. The Pittsburg group was visited by TI representatives and saw demonstrations of coming products. LOGO, TEXNET telecommunications network, the EDITOR/ASSEMBLER software and several unreleased games were shown. The August 19, 1983 list contained over 175 groups with 20 being in either Australia, Belgium, Columbia, England, or Germany.

The users groups were a great source of free advertising for TI. The newsletters with product reviews and group demonstrations sold a lot of software for TI. In return, they were, in the end, mislead.

The letter from Texas Instrument's Ed Weist, Users Group Co-ordinator, referred to by Jim Horn in Chapter 2 is the proof. The letter, dated July 27, 1983 first, announced TI's $100 million after tax losses for the second quarter of 1983 and an actual net loss of $119.2 million and then alluded to the speculation by "some people" about the possibility of "TI getting out of the home computer business". The remainder of the letter went like this:

"The question most often asked: 'Is TI getting out of the Home Computer business?'. That question was answered in the same news release mentioned above which states, 'TI will continue aggressive cost reduction measures, development of new hardware, vigorous software expansion, and emphasis on merchandising and dealer support for the approximately 20,000 retail outlets around the world now carrying 99/4A Home Computers, software and peripherals'.

Even though TI is remaining in the home computer business, our commitment to that market is being questioned. Some people, who own the 99/4Am feel that although they now have an excellent computer, TI will not be committed to the business and thus, service and software support for the 99/4A will collapse.

This concern was also addressed in the press release of July 22 quoted here:

To support our world-wide network of retail outlets, we are emphasising increased marketing programs that will highlight the capability and value of our home computers. We are continuing aggressive development of new cartridge software and have recently signed contracts with major software firms including Imagic, Broderbund, Spinnaker, and SEGA Enterprises. In-house, we are continuing cost reduction efforts.

In the longer term, we believe that the continually decreasing costs of semiconductor logic and memory will result in a stream of high performance computing and other electronic products in the under $1000 category. Increasing volumes of these products will move through mass distribution channels that TI has pioneered with its home computer.'

As you can see, we are solidly in and committed to the home computer business. Furthermore, we care about you. This is evident through our support of your users group. By the way, the TI network of users groups now contain over 170 groups. So, as a TI Home Computer owner you are not alone, but are part of a very large community that is growing every day."

A large smoke screen is apparent. As Mr. Horn pointed out in his earlier remarks, many questions were asked in the letter, no solid answers were apparent. There was no clear statement as to whenever, indeed, TI was going to stay in the 99/4A "business". References to solutions to the huge second quarter 1983 losses are made, but no guarantees are in print. Support for retail outlets are quoted, and it is stated that TI does support users groups. The "reassurances" at the time were effective. In retrospect, we see their ambiguity.

The last user group communication before the October withdrawal was dated September 6, 1983. Again from Ed Weist, it was completely benign. No hints, no warnings of the future. On the contrary, Weist enclosed his September/October schedule of user group visits which extended up to a October 2nd meeting of the Milwaukee Area Users Group. The information from tI to their biggest supporters, the users groups, was that "all was well".

After the news did hit and the shock and panic had subsided, it has been the users groups who have kept the machine and its individual users productive. With the fire-sales and sell-outs, many of the new owners were actively recruited and absorbed by the groups. Their membership roles swelled and their jobs grew enormously. They, almost overnight, became the sole source suppliers of technical and programming information for the novice 99/4A users. Later, they became a major source of compatible hardware as the TI retail base vanished quickly. They were able to buy in bulk and sell at cost to the members. The ties between groups were strong and sharing of hardware, software, and sources of commercial products was widespread. When IUG began to wither and die, the local user group's public domain libraries became almost a sole source suppliers of software for the members. It serves as a tribute to the value of the user groups that they remain the focal point of the 99/4A community even now, two years after their machines were abandoned. Certainly, the membership roles have diminished, but the enthusiasm has not. And the majority of the groups remain today. Some of the strongest were formed after the October debacle, when new owners without a local group found each other and forged ahead with their machines. They were assisted by the older groups and, now, are successful and serve their memberships well.

TI made some final offerings to users groups in late 1984. They released to public-domain the commercially developed (but never released to the market) TI FORTH, a powerful and popular language for the 99/4A. It was released through the users groups and each of the recognised groups were sent the system disk and manual. It was a major concession. Further, the popular word processor TI Writer and spreadsheet, Multiplan (Microsoft) in initial commercial release, had several minor flaws in the programs. TI released to the users groups new versions

which corrected these flaws. Crumbs after the feast, certainly, but concessions that didn't have to be made. Cries from the users groups to get another language, PILOT, known to be developed, released to public-domain, were not successful. Some of the larger groups across the country became focal points for major areas of interest. For example the Northwest Ohio 99'ers (actually two groups, New Horizons and OH-MI-TI) have been an amazingly productive and influential group. They, through the work of hardware genius Ron Gries and software wizards John Clulow, Dave Romer have produced software and schematics to build the hardware for an inexpensive Bulletin Board System. They have also built a battery backed 8K cartridge, added 32K ("Kilobits") of memory expansion directly into the console "mother-board" (negating the need for the hard to find peripheral expansion boxes) and, most recently, hardware and software to build an inexpensive "RAM disk" (which allows rapid storage and retrieval of data to and from a set of soldered chips). This kind of "homebrew" work, which characterised the early days of personal computers, has been all but lost in today's modern, pre-packaged and "bundled" ("all you have to do is plug it in") world of home computers. Being orphaned brings back the necessity. But you sense it's not just out of necessity; it is also for the sheer fun of it. To take a machine that the commercial world has given up on and make it do something new and wondrous brings a satisfaction that is unmatched in computerdom. And nobody does it better than the Northwest Ohio Users Groups.

Software is another way a user group can distinguish itself. Here, there are numerous examples. From the small group in Muscle Shoals, Alabama (where members Danny Michael and John Taylor have produced and made available numerous useful utilities) to the huge (and possibly first TI users group) Houston, Texas group where Stephen Foster, Bill Knecht and Bill Rister have combined to release over 50 separate pieces of "computer music" (software that, when run, creates music played through the computer's sound chip), from jazz to hymnals.

Information is a wall all the users groups have contributed to keeping the 99/4A viable. Through newsletters, varying in quality from typed and xeroxed to typeset and printed and size from 2 pages to over 20 pages per month, the groups mail out to their members (as part of membership dues) as well as other user groups to keep the grapevine of information flowing. By exchanging regional information, the individual groups stay abreast of nationwide products and reviews, share program listings and software and hardware tips. Filling the gap left by lack of glossy magazine coverage, these newsletter exchanges provide essential information sources even more up to date (and often more factual, due to lack of advertiser's pressures) than commercial publications.

One of the most unique and successful ventures carried out by a users group has been the yearly Chicago Users Group's "TI Faire". First Scheduled totally innocent of the implications of the timing, just two weeks after the October, 1983 withdrawal of Texas Instruments, the group was overwhelmed with the response. That 1983 Faire drew over 1000 visitors and prompted an incredible buying spree from displaying vendors. The second annual Faire was held a year later (November 10, 1984) and drew even more visitors - estimated at some 1500 users. Don Bynum, the former engineer from Texas Instruments and now 99/4A entrepreneur, was the guest speaker. His talk was videotaped and made available to other users groups as another information service. Twenty-one commercial vendors of support products for the 99/4A set up booths.

Listings

And now some listings to keep you all amused. All these are provided by Richard Twyning and several require the use of the Missing Link (which should be available from the library.) Happy typing!

```
1 SP=127 :: CALL CLEAR :: CALL CHAR(128,"0000000000000030F3FFF3F0F030
0000000000000030F0F0F0F0F0F0F030")
2 CALL CHAR(132,"00000000000C0F0F0F0F0F0F0F0F0F0C0000000000000C0F0FCF
FFCF0C00000")
3 CALL CHAR(136,"C0F0FCFFFFFFFFFFFFFFF3F0F03000000000000C0F0F0F0F0F0F
0F0F0F0F030")
4 CALL CHAR(140,"00000000030F0F0F0F0F0F0F0F0F0F0C030F3FFFFFFFFFFFFFFF
FFCF0C00000")
5 CALL SPRITE(#1,128,4,96,112,#2,132,4,96,128,#3,136,13,118,112,#4,140
,3,118,128):: CALL MAGNIFY(4)
6 CALL SPRITE(#5,128,10,96,112,#6,132,10,96,128,#7,136,7,118,112,#8,14
0,9,118,128)
26 CALL INIT :: CALL LOAD(-
31806,64):: CALL MOTION(#1,SP,SP,#2,SP,SP,#3,SP,SP,#4,SP,SP)
27 CALL MOTION(#5,-SP,-SP,#6,-SP,-SP,#7,-SP,-SP,#8,-SP,-
SP):: CALL LOAD(-31806,16):: ACCEPT A$
```

THE MISSING LINK

```
1 FOR Z=20 TO 21
100 CALL LINE3D(60,30,Z,80,30,Z)
110 CALL LINE3D(80,30,Z,80,42,Z):: CALL LINE3D(80,42,Z,83,45,Z):: CALL
 LINE3D(83,45,Z,90,48,Z)
111 CALL LINE3D(90,48,Z,87,58,Z)
120 CALL LINE3D(87,58,Z,79,58,Z):: CALL LINE3D(79,58,Z,76,68,Z):: CALL
 LINE3D(76,68,Z,85,68,Z)
130 CALL LINE3D(85,68,Z,81,90,Z):: CALL LINE3D(81,90,Z,83,93,Z)
131 CALL LINE3D(83,93,Z,90,97,Z):: CALL LINE3D(90,97,Z,95,97,Z):: CALL
 LINE3D(95,97,Z,102,92,Z)
132 CALL LINE3D(102,92,Z,102,87,Z)
140 CALL LINE3D(102,87,Z,100,87,Z):: CALL LINE3D(100,87,Z,98,85,Z):: C
ALL LINE3D(98,85,Z,99,77,Z)
141 CALL LINE3D(99,77,Z,102,68,Z)
150 CALL LINE3D(102,68,Z,112,68,Z):: CALL LINE3D(112,68,Z,114,58,Z)
151 CALL LINE3D(114,58,Z,104,58,Z):: CALL LINE3D(104,58,Z,106,50,Z)
160 CALL LINE3D(106,50,Z,120,50,Z):: CALL LINE3D(120,50,Z,124,52,Z)
161 CALL LINE3D(124,52,Z,125,63,Z):: CALL LINE3D(125,63,Z,128,70,Z)::
CALL LINE3D(128,70,Z,129,80,Z)
162 CALL LINE3D(129,80,Z,103,102,Z)!!!!!!!!!!!!!!!
170 CALL LINE3D(102,103,Z,105,102,Z):: CALL LINE3D(105,102,Z,110,102,Z
):: CALL LINE3D(110,102,Z,113,105,Z)
180 CALL LINE3D(113,105,Z,117,95,Z):: CALL LINE3D(117,95,Z,115,90,Z)::
 CALL LINE3D(115,90,Z,110,85,Z)
181 CALL LINE3D(110,85,Z,88,72,Z)
190 CALL LINE3D(88,72,Z,89,65,Z):: CALL LINE3D(89,65,Z,94,57,Z):: CALL
 LINE3D(94,57,Z,94,55,Z)
191 CALL LINE3D(94,55,Z,80,47,Z):: CALL LINE3D(80,47,Z,67,35,Z)
200 CALL LINE3D(67,35,Z,67,60,Z):: CALL LINE3D(67,60,Z,30,60,Z)
210 CALL LINE3D(53,93,Z,53,101,Z)
```

```
220 CALL LINE3D(53,101,Z,82,94,Z):: CALL LINE3D(82,94,Z,82,86,Z):: CAL
L LINE3D(82,86,Z,53,93,Z)
230 CALL LINE3D(32,99,Z,32,102,Z)!
240 CALL LINE3D(102,32,Z,105,35,Z):: CALL LINE3D(105,35,Z,105,38,Z)
241 CALL LINE3D(105,38,Z,101,41,Z):: CALL LINE3D(101,41,Z,98,41,Z):: C
ALL LINE3D(98,41,Z,95,38,Z)
242 CALL LINE3D(95,38,Z,95,35,Z):: CALL LINE3D(95,35,Z,99,32,Z)
300 NEXT Z
1002 CALL KEY(0,K,S):: IF S=0 THEN 1002
30000 SUB POINT3D(X2,Y2,Z2):: ZDIV=Z2*0.42 :: ZDIV2=Z2*.349 :: SX=512-
ZDIV :: SY=424-ZDIV2 :: DX=(512-SX)/2 :: DY=(424-SY)/2 :: R=424-DY-
(SY/424*Y2)
30001 C=DX+(SX/512*X2):: CALL LINK("PIXEL",192/424*R,240/512*C):: SUBE
ND
30009 SUB LINE3D(X2,Y2,Z2,X3,Y3,Z3):: ZDIV=Z2*0.42 :: ZDIV2=Z2*.349 ::
 SX=512-ZDIV :: SY=424-ZDIV2 :: DX=(512-SX)/2 :: DY=(424-
SY)/2 :: R=424-DY-(SY/424*Y2)
30010 C=DX+(SX/512*X2)
30011 ZDIV=Z3*0.42 :: ZDIV2=Z3*.349 :: SX=512-ZDIV :: SY=424-
ZDIV2 :: DX=(512-SX)/2 :: DY=(424-SY)/2 :: R2=424-DY-(SY/424*Y2)
30012 C2=DX+(SX/512*X3):: CALL LINK("LINE",192/424*R,240/512*C,192/424
*R2,240/512*C2):: SUBEND

1 SP=120 :: CALL INIT :: CALL LOAD(-
31806,64):: CALL CHAR(140,RPT$("F",64))
2 FOR D=1 TO 28 :: CALL SPRITE(#D,140,2,96,128,0,0):: NEXT D
3 FOR D=1 TO 7 :: CALL MOTION(#D,SP/D,SP/D):: NEXT D :: FOR D=8 TO 14
:: CALL MOTION(#D,-SP/(D-7),SP/(D-7)):: NEXT D
4 FOR D=15 TO 21 :: CALL MOTION(#D,SP/(D-14),-SP/(D-
14)):: NEXT D :: FOR D=22 TO 28 :: CALL MOTION(#D,-SP/(D-21),-SP/(D-
21)):: NEXT D
5 CALL LOAD(-31806,16):: CALL MAGNIFY(4)
6 FOR D=1 TO 26 :: PRINT :: NEXT D :: CALL SAY("TRY+THIS+ON+A1+P+C")::
 ACCEPT A$
10 CALL DELSPRITE(#7,#14,#21,#28)
11 ACCEPT A$
12 CALL DELSPRITE(#6,#13,#20,#27)
13 ACCEPT A$
14 CALL DELSPRITE(#5,#12,#19,#26)
15 CALL SAY("#TEXAS INSTRUMENTS#+T+I+NINETY+NINE+FOUR+A+HOME+COMPUTER"
):: ACCEPT A$
16 CALL DELSPRITE(#4,#11,#18,#25)
17 ACCEPT A$
18 CALL DELSPRITE(#3,#10,#17,#24)
19 ACCEPT A$
20 CALL DELSPRITE(#2,#9,#16,#23)
999 CALL SOUND(100,900,0)
1000 ACCEPT A$
```

THE MISSING LINK

```
1 P=.3 :: K=3
2 A=0
3 X=5000
4 CALL LINK("PIXEL",90+(P*20),240/X*A):: P=P+K*P*(1-
P):: A=A+1 :: GOTO 4
```

Listings

THE MISSING LINK

```
1 IT=10 :: P=.2 :: M=80
2 CALL LINK("LINE",1,1,1,240):: CALL LINK("LINE",1,240,192,240):: CALL
 LINK("LINE",192,240,192,1)
3 CALL LINK("LINE",192,1,1,1):: CALL LINK("PRINT",3,3,"Feigenbaum Diag
ram,")
4 CALL LINK("PRINT",12,3,"plotted by Richard Twyning"):: CALL LINK("PR
INT",21,3,"With THE MISSING LINK")
5 CALL LINK("PRINT",3,170,"ITER="&STR$(IT)):: CALL LINK("PRINT",12,170
,"P="&STR$(P)):: CALL LINK("PRINT",21,170,"M="&STR$(M))
100 FOR K=3 TO 0 STEP -.002 :: V=P
110 FOR I=1 TO IT :: CALL LINK("PIXEL",190-(V*100),K*M):: V=V+K*V*(1-
V):: NEXT I:: NEXT K
120 CALL LINK("SAVEP","DSK1.CHAOS",1)
130 CALL KEY(0,K,S):: CALL SAY("FINISHED"):: IF S=0 THEN 120
```

THE MISSING LINK

```
1 IT=400 :: P=.2 :: M=580
2 CALL LINK("LINE",1,1,1,240):: CALL LINK("LINE",1,240,192,240):: CALL
 LINK("LINE",192,240,192,1)
3 CALL LINK("LINE",192,1,1,1):: CALL LINK("PRINT",3,3,"Feigenbaum Diag
ram,")
4 CALL LINK("PRINT",12,3,"plotted by Richard Twyning"):: CALL LINK("PR
INT",21,3,"With THE MISSING LINK")
5 CALL LINK("PRINT",3,170,"ITER="&STR$(IT)):: CALL LINK("PRINT",12,170
,"P="&STR$(P)):: CALL LINK("PRINT",21,170,"M="&STR$(M))
100 FOR K=2.6 TO 2.2 STEP -
.002 :: V=P :: FOR INV=1 TO 50 :: V=V+K*V*(1-
V):: NEXT INV :: CALL SOUND(100,900,0)
110 FOR I=1 TO IT :: CALL LINK("PIXEL",639-(V*1000),-
1400+(K*M)):: V=V+K*V*(1-V):: NEXT I :: NEXT K
120 CALL LINK("SAVEP","DSK1.BIGCHAOS",1)
130 CALL KEY(0,K,S):: CALL SAY("FINISHED"):: IF S=0 THEN 120
```

THE MISSING LINK

```
1 X1=30 :: Y1=20 :: X2=170 :: Y2=170 :: DEF RAD(A)=A*PI/180
2 X3=((X2-X1)/2)+X1 :: Y3=((Y2-
Y1)/2)+Y1 :: CALL LINK("PIXEL",Y1,X1):: CALL LINK("PIXEL",Y2,X2):: CAL
L LINK("PIXEL",Y3,X3)
3 DIR$="B"
4 XRAD=X3-X1 :: YRAD=Y3-Y1
5 IF DIR$="T" THEN CX=X1 :: CY=Y3 :: SA=270 :: EA=360 ELSE CX=X3 :: CY
=Y1 :: SA=90 :: EA=180
6 FOR ANGLE=SA TO EA :: CALL LINK("PIXEL",CY+(YRAD*SIN(RAD(ANGLE))),CX
+(XRAD*COS(RAD(ANGLE))))):: NEXT ANGLE
7 XRAD=X2-X3 :: YRAD=Y2-Y3
8 IF DIR$="T" THEN CX=X2 :: CY=Y3 :: SA=90 :: EA=180 ELSE CX=X3 :: CY=
Y2 :: SA=270 :: EA=360
9 FOR ANGLE=SA TO EA :: CALL LINK("PIXEL",CY+(YRAD*SIN(RAD(ANGLE))),CX
+(XRAD*COS(RAD(ANGLE))))):: NEXT ANGLE
10 CALL SAY("FINISHED")
1000 CALL KEY(0,K,S):: IF S=0 THEN 1000
```

THE MISSING LINK

```
1 O=0 :: D=0 :: FOR Z=1215 TO 0 STEP -
60 :: FOR X=0 TO 500 STEP 40 :: IF D=0 THEN D=1 :: GOTO 3
2 D=0 :: FOR FILL=0 TO 40 STEP 2 :: CALL LINE3D(X+FILL,0,Z,X+FILL,0,Z-
60):: NEXT FILL
3 NEXT X :: IF O=0 THEN O=1 :: D=0 ELSE O=0 :: D=1
4 NEXT Z
10 CALL LINE3D(0,0,0,0,0,1215):: CALL LINE3D(0,424,0,0,424,1215):: CAL
L LINE3D(512,0,0,512,0,1215)
11 CALL LINE3D(512,424,0,512,424,1215)
12 CALL LINK("LINE",1,1,1,240):: CALL LINK("LINE",1,240,192,240):: CAL
L LINK("LINE",192,240,192,1):: CALL LINK("LINE",192,1,1,1)
400 CALL KEY(0,K,S):: IF S=0 THEN 400 ELSE END
500 CALL LINK("DUMP")
1000 CALL KEY(0,K,S):: IF S=0 THEN 1000
30000 SUB POINT3D(X2,Y2,Z2):: ZDIV=Z2*0.42 :: ZDIV2=Z2*.349 :: SX=512-
ZDIV :: SY=424-ZDIV2 :: DX=(512-SX)/2 :: DY=(424-SY)/2 :: R=424-DY-
(SY/424*Y2)
30001 C=DX+(SX/512*X2):: CALL LINK("PIXEL",192/424*R,240/512*C):: SUBE
ND
30009 SUB LINE3D(X2,Y2,Z2,X3,Y3,Z3):: ZDIV=Z2*0.42 :: ZDIV2=Z2*.349 ::
 SX=512-ZDIV :: SY=424-ZDIV2 :: DX=(512-SX)/2 :: DY=(424-
SY)/2 :: R=424-DY-(SY/424*Y2)
30010 C=DX+(SX/512*X2)
30011 ZDIV=Z3*0.42 :: ZDIV2=Z3*.349 :: SX=512-ZDIV :: SY=424-
ZDIV2 :: DX=(512-SX)/2 :: DY=(424-SY)/2 :: R2=424-DY-(SY/424*Y2)
30012 C2=DX+(SX/512*X3):: CALL LINK("LINE",192/424*R,240/512*C,192/424
*R2,240/512*C2):: SUBEND
```

```
1 CALL CLEAR :: CALL CHAR(130,"FF"&RPT$("81",6)&"FF"):: CALL CHAR(131,
RPT$("F",16)):: CALL CHAR(132,RPT$("01",8)):: CALL CHAR(133,RPT$("80",
8))
2 CALL CHAR(134,RPT$("0",14)&"FF"):: CALL CHAR(135,"FF"&RPT$("0",14)):
: DIM CH$(1,126),BIN$(255):: FOR R=0 TO 1 :: FOR C=0 TO 126 :: CH$(R,C
)=RPT$(CHR$(0),18)
3 NEXT C :: NEXT R :: GOSUB 10000 :: CALL HCHAR(9,1,134,20):: CALL HCH
AR(10,1,135,20):: CALL HCHAR(13,1,134,20):: CALL HCHAR(14,1,135,20)
4 CALL VCHAR(1,10,132,19):: CALL VCHAR(1,11,133,19):: R,C=6 !:for R=2
TO 17 :: CALL HCHAR(R,2,130,18):: NEXT R
5 DISPLAY AT(1,20):"RICHARD" :: DISPLAY AT(2,20):"TWYNING'S" :: DISPLA
Y AT(4,20):"CHARACTER" :: DISPLAY AT(5,20):"GENERATOR"
6 DISPLAY AT(20,4):"MENU" :: DISPLAY AT(21,4):RPT$(CHR$(135),4)
7 DISPLAY AT(22,1):"1.EDIT CHARACTER   4.QUIT" :: DISPLAY AT(23,1):"2.
LOAD CHARACTERS" :: DISPLAY AT(24,1):"3.SAVE CHARACTERS"
100 CALL GCHAR(R,C,CR):: CALL HCHAR(R,C,30):: CALL HCHAR(R,C,CR):: CAL
L KEY(0,K,S):: IF S=0 THEN 100
101 IF K=ASC("E")OR K=11 THEN R=R-1
102 IF K=ASC("X")OR K=10 THEN R=R+1
103 IF K=ASC("S")OR K=8 THEN C=C-1
104 IF K=ASC("D")OR K=9 THEN C=C+1
105 IF R<2 THEN R=2
106 IF R>17 THEN R=17
```

```
107 IF C<2 THEN C=2
108 IF C>19 THEN C=19
109 IF K=ASC("1")THEN 1000
110 IF K=ASC("2")THEN 2000
111 IF K=ASC("3")THEN 3000
112 IF K=ASC("4")THEN CALL SURE(Y):: IF Y=0 THEN 100 ELSE END
120 GOTO 100
1000 !EDIT CHARACTER
1001 DISPLAY AT(10,20):" CTRL ." :: DISPLAY AT(11,19):"or ESCAPE" :: D
ISPLAY AT(12,19):"to exit"
1002 CALL SAY("PRESS+THE1+CORRECT+KEY+FOR+THE1+DATA+YOU+WANT+TO+DRAW")
1003 CALL KEY(0,A,S):: IF S=0 THEN 1003
1004 IF A<32 OR A>126 THEN 1003 ELSE CALL HCHAR(20,20,A)
1005 FOR R=0 TO 1 :: FOR C=2 TO 19 :: FOR B=1 TO 8 :: CALL HCHAR((R*8)
+1+B,C,ASC(SEG$(BIN$(ASC(SEG$(CH$(R,A),C-
1,1))),B,1))):: NEXT B :: NEXT C :: NEXT R :: R,C=3
1006 CALL GCHAR(R,C,CR):: CALL HCHAR(R,C,30):: CALL HCHAR(R,C,CR):: CA
LL KEY(4,K,S):: IF S=0 THEN 1006
1007 IF K=ASC("E")OR K=139 THEN R=R-1
1008 IF K=ASC("X")OR K=138 THEN R=R+1
1009 IF K=ASC("S")OR K=136 THEN C=C-1
1010 IF K=ASC("D")OR K=137 THEN C=C+1
1011 IF R<2 THEN R=2
1012 IF R>17 THEN R=17
1013 IF C<2 THEN C=2
1014 IF C>19 THEN C=19
1015 IF K=ASC("1")OR K=3 THEN DR=0
1016 IF K=ASC("2")OR K=4 THEN DR=1
1017 IF K=27 THEN GOTO 1400
1018 IF DR=1 THEN CALL HCHAR(R,C,131)ELSE CALL HCHAR(R,C,130)
1019 GOTO 1006
1400 DISPLAY AT(10,20):"" :: DISPLAY AT(11,19):"" :: DISPLAY AT(12,19)
:""
1500 CH$(0,A),CH$(1,A)=""
1501 FOR R=0 TO 1 :: FOR C=2 TO 19 :: DEC=0 :: V=1 :: FOR B=(R*8)+9 TO
 (R*8)+2 STEP -1 :: CALL GCHAR(B,C,X):: IF X=131 THEN DEC=DEC+V
1502 V=V*2 :: NEXT B :: CH$(R,A)=CH$(R,A)&CHR$(DEC):: NEXT C :: NEXT R
1503 R,C=2 :: GOTO 100
2000 !LOAD CHARACTERS
2001 CALL SAY("ENTER+DISKETTE+DEVICE+NAME"):: ACCEPT AT(16,1):F$ :: OP
EN #1:F$,INTERNAL,VARIABLE 20
2002 FOR C=32 TO 126 :: FOR R=0 TO 1 :: INPUT #1:CH$(R,C):: NEXT R ::
NEXT C :: CLOSE #1 :: R,C=2 :: GOTO 100
3000 !SAVE CHARACTERS
3001 CALL SAY("ENTER+DISKETTE+DEVICE+NAME"):: ACCEPT AT(16,1):F$ :: OP
EN #1:F$,INTERNAL,VARIABLE 20
3002 FOR C=32 TO 126 :: FOR R=0 TO 1 :: PRINT #1:CH$(R,C):: NEXT R ::
NEXT C :: CLOSE #1 :: R,C=2 :: GOTO 100
10000 V=0 :: FOR B1=0 TO 1 :: FOR B2=0 TO 1 :: FOR B3=0 TO 1 :: FOR B4
=0 TO 1 :: FOR B5=0 TO 1 :: FOR B6=0 TO 1 :: FOR B7=0 TO 1 :: FOR B8=0
 TO 1
```

```
10001 BIN$(V)=CHR$(B1+130)&CHR$(B2+130)&CHR$(B3+130)&CHR$(B4+130)&CHR$
(B5+130)&CHR$(B6+130)&CHR$(B7+130)&CHR$(B8+130):: V=V+1
10002 DISPLAY AT(3,2):BIN$(V-
1):: NEXT B8 :: NEXT B7 :: NEXT B6 :: NEXT B5 :: NEXT B4 :: NEXT B3 ::
 NEXT B2 :: NEXT B1 :: RETURN
30000 SUB SURE(Y):: CALL SAY("ARE+YOU+SURE.PRESS+Y+OR+N")
30001 CALL KEY(0,K,S):: IF K=ASC("Y")OR K=ASC("y")THEN Y=1 :: SUBEXIT
30002 IF K=ASC("N")OR K=ASC("n")THEN Y=0 :: SUBEXIT
30003 GOTO 30001
30004 SUBEND
```

```
1 DI=12800 :: CALL MAGNIFY(3):: SP=3 :: CH=32 :: FOR R=1 TO 6 :: FOR C
=1 TO 4 :: CALL SPRITE(#SP,CH,2,R*26,C*26,1,1):: SP=SP+1 :: CH=CH+4 ::
 NEXT C :: NEXT R
2 CALL PATTERN(#12,64):: CALL CHAR(32,"3F20203F2D2D202D2D202D2D202D2D3
FFC0404FCB4B404B4B404B4B404B4B4FC")
3 CALL CHAR(36,"20303C7FF7F313FF1FFF7F381C0F00001030F0F8BC3C20FCE0FC78
70E0C00000")
4 CALL CHAR(40,"032E172F3F77501A1A1A1A1A1A1A08070000C0E0F0D010B0B0B0B0
B0B0B020C0")
5 CALL CHAR(44,"7F507750775077FF80B3A9B1A1A380FFFE0E8A0ECA0EEAFF01BD25
2525BD01FF")
6 CALL CHAR(48,"0000000000F088E08B8A8A0000000000000000000000080808818A8BC
0000000000")
7 CALL CHAR(52,"0304091111100804030000868898A6980402010109020408000000
040415A615")
8 CALL CHAR(56,"030D11112110100C03708580641415E5C030080804C82830C000EF
284E8808EF")
9 CALL CHAR(60,"CEACC8AE006552526200008E4E2E4E8E40ACE0A0000000000")
10 CALL CHAR(64,"F0808D8D808D8D808D8D808D8D8080F00F01B1B101B1B101B1B10
1B1B101010F")
11 CALL CHAR(72,"FF8080808080808080B0A9AAAAA980FFF0282422213F0101017D2
9ADA92D01FF")
12 CALL CHAR(76,"031C233C0000010202020201000102010C038C4320A728C7040404
08000804080")
13 CALL CHAR(80,"F14A4401020E7E7E7E7E7E0E02010000000000E03030303030303
03030E00000")
14 CALL CHAR(84,"0000F010101E0202030000000000000000000000E0C0A010C0404
07808080F00")
15 CALL CHAR(88,"0000F010101E0202030000000000000000000000020140CDC404
07808080F00")
16 CALL CHAR(92,"8BD9A9A9AB001F11151112121110101F915B55559500F80818884
848880808F8")
17 CALL CHAR(96,"66884828C600CAAAAAAAC40000000000C9ADCBA9A90096F596949
40000000000")
18 CALL CHAR(100,"7189080911202101200000E94D4B4BE9B6B600B6B600B6B60000
007245654542")
19 CALL CHAR(104,"6DED607F6D0B7D6D803844FF808080FFA4C48495950ECEA40000
00E0202020E0")
20 CALL CHAR(108,"FE9282928282FE0000000000000000000000F808082A1C08007F
49414941417F")
```

```
21 CALL CHAR(112,"FF55FF0001011D0E006E00FF55FF0037FF55FF008080F0E000EE
00FF55FF007C")
22 CALL CHAR(116,"AEA5E5A5AE00AA0055002A00D5005F00324622126700AA005500
AA005600F4")
23 CALL CHAR(120,"FF8080808080808080808080808080FFFF010101010101010101
0101010101FF")
24 CALL CHAR(124,"FF8080808080808080808080808080FFFF010101010101010101
0101010101FF")
999 CALL SPRITE(#1,132,2,96,124):: CALL CHAR(132,"100C0F07070200000000
0000000000000000000800080402010000000000000000")
1000 FOR C=14 TO 0 STEP -1 :: CALL COLOR(C,8,8):: NEXT C
1001 CALL JOYST(1,X,Y):: CALL MOTION(#1,-
Y*3,X*3):: CALL KEY(1,K,S):: IF K=18 THEN 1002 ELSE 1001
1002 FOR D=26 TO 1 STEP -
1 :: CALL MOTION(#D,0,0):: NEXT D :: CALL CHARSET :: FOR D=3 TO 26 ::
CALL DISTANCE(#1,#D,DIS):: IF DIS<DI THEN DI=DIS :: S=D
1003 NEXT D
1004 PRINT "Sprite ";S;" was chosen"
```

```
1 CALL MAGNIFY(3):: IS=40 :: TS=127 :: CALL INIT :: CALL LOAD(-
31806,64)
2 CALL SPRITE(#18,76,2,96,67,0,IS,#19,72,2,96,101,0,IS,#20,68,2,96,85,
0,IS,#21,64,2,99,69,0,IS)
3 CALL SPRITE(#22,60,2,111,57,0,IS,#23,56,2,114,41,0,IS,#24,48,2,130,3
8,0,IS,#25,52,2,144,54,0,IS)
4 CALL SPRITE(#26,36,2,146,27,0,IS,#27,40,2,146,43,0,IS,#28,44,2,146,5
9,0,IS)
5 CALL LOAD(-
31806,16):: FOR D=65 TO 90 :: CALL CHARPAT(D,A$):: CALL CHAR(D+32,A$):
: NEXT D
10 CALL CHAR(36,"000000000102040409112040408180 7F20408080000000E0081EC
82828C600FF")
11 CALL CHAR(40,RPT$("0",20)&"7192926900FF080402010100000001012D41814D2
00FF")
12 CALL CHAR(44,RPT$("0",10)&"80402020100804040202FC"&RPT$("0",18))
13 CALL CHAR(48,"2828281416090601070810202040808022261A1434C830C0F0080
4020201")
14 CALL CHAR(52,"8080"&RPT$("0",47))
15 CALL CHAR(56,RPT$("0",22)&"0E314EB1A0"&RPT$("0",18)&"03040A916BC4A8
")
16 CALL CHAR(60,RPT$("0",10)&"0102041A314AA418A04080040A314AA418B04080
00")
17 CALL CHAR(64,RPT$("0D",6)&"0F1D2F25122946A418B07CFEC7838383E3D39320
C080")
18 CALL CHAR(68,"303030FC3030303031391F0F01010000"&RPT$("0",12)&"30FCC
E86FFFF80C6FE38")
19 CALL CHAR(72,RPT$("60",10)&"E0E0"&RPT$("0",27))
20 CALL CHAR(76,"0303"&RPT$("0",64))
21 CALL CHAR(80,"0103030303030303FF80C04060381C0EFC0405050406020C19212
13D050505C4")
22 CALL CHAR(84,"0080404080000C12BA8ABAA2A1A1A1220000000000000000000000
")
```

```
23 CALL CHAR(88,"F84C040603010000000000000000000093640810 10C8F80000000
000")
24 CALL LOAD(-
31806,64):: CALL SPRITE(#15,80,2,30,114,0,TS,#16,84,2,30,130,0,TS,#17,
88,2,46,120,0,TS):: CALL LOAD(-31806,16)
30 PRINT "":" a demo by richard twyning ":"":"":"":"":"":"":"":"":"
":"":"":"":"":"":"":"":"":"":"":""
999 CALL LOAD(-31806,16):: PRINT "      i blame it on intel"
1000 CALL KEY(0,K,S):: IF S=0 THEN 1000
```

TI Basic + Mini Memory

```
100 CALL CLEAR
110 PRINT TAB(7);"*****************":TAB(7);"*";TAB(22);"*"
120 PRINT TAB(7);"* MINI INVADER *";TAB(7);"*";TAB(22);"*":TAB(7);"****
*************": :
130 PRINT TAB(5);"MINI-
MEMORY REQUIRED": : : :TAB(3);"Use 'S' Înd 'D' to move.":  :
140 PRINT TAB(6);"Space Bar to Fire.": : : :"Program Copyright,March 1
984        D.A.Whitaker": : :
150 PRINT " PRESS ANY KEY TO CONTINUE"
160 GOSUB 1320
170 H=0
180 RANDOMIZE
190 CALL CLEAR
200 CALL SCREEN(5)
210 RESTORE 220
220 DATA 138,139,140,141,73,0,1,-1,128,0
230 READ I1,I2,I3,I4,P1,Q,V,L,Z,SC
240 FOR I=1104 TO 1128 STEP 8
250 CALL POKEV(I,255,153,153,255,36,66,66,66)
260 NEXT I
270 CALL POKEV(1280,48,48,48,48,48,48,48,48,"",1616,255,255,0,0,0,0,0,
0,"",780,208)
280 CALL POKEV(784,248,184,248,248,248,248,248,248,248,248)
290 CALL POKEV(1536,24,24,60,255,255,255,66,66)
300 CALL HCHAR(21,1,106,32)
310 CALL POKEV(768,183,16,192,15,183,32,192,1,183,48,192,11)
320 CALL POKEV(9,173,169,174,169,Z,Z,169,174,182,161,164,165,178)
330 CALL POKEV(133,176,178,165,179,179,Z,161,174,185,Z,171,165,185,Z,1
80,175,Z,179,180,161,178,180)
340 CALL POKEV(692,179,163,175,178,165,Z,157,144)
350 CALL POKEV(673,168,169,Z,179,163,175,178,165,Z,157)
360 GOSUB 1400
370 GOSUB 1320
380 CALL HCHAR(5,6,32,22)
390 GOSUB 1230
400 P=120
410 GOSUB 890
420 CALL KEY(0,K,S)
430 C=INT(P/8)+1
440 IF S=0 THEN 810
450 ON POS("SD ",CHR$(K),1)+1 GOTO 810,460,500,530
460 IF P<8 THEN 420
```

```
470 P=P-5
480 CALL POKEV(765+(V*4),P)
490 GOTO 420
500 IF P>240 THEN 420
510 P=P+5
520 GOTO 480
530 CALL SOUND(-1000,3000,5,-4,0)
540 FOR I=576+C TO P1-32 STEP -32
550 CALL PEEKV(I,X)
560 IF (X>137)*(X<142)THEN 600
570 CALL POKEV(I,160,"",I,Z)
580 NEXT I
590 GOTO 910
600 CALL SOUND(-1200,110,5,-6,0)
610 FOR I=1 TO 20
620 CALL POKEV(784,INT(RND*16))
630 NEXT I
640 CALL POKEV(784,248)
650 SC=SC+50
660 GOSUB 1350
670 Q=Q+1
680 ON X-137 GOTO 690,720,750,780
690 I1=Z
700 GOSUB 890
710 GOTO 820
720 I2=Z
730 GOSUB 890
740 GOTO 820
750 I3=Z
760 GOSUB 890
770 GOTO 820
780 I4=Z
790 GOSUB 890
800 GOTO 820
810 IF RND<.6 THEN 910
820 CALL POKEV(P1,Z,"",P1+4,Z,"",P1+8,Z,"",P1+12,Z)
830 IF Q=4 THEN 1200
840 P1=P1+INT(RND*3+31)
850 GOSUB 890
860 CALL SOUND(-20,-7,0)
870 IF P1>604 THEN 1140
880 GOTO 420
890 CALL POKEV(P1,I1,"",P1+4,I2,"",P1+8,I3,"",P1+12,I4)
900 RETURN
910 F=P1+INT(RND*4)*4
920 CALL PEEKV(F,X)
930 IF X=Z THEN 910
940 CALL SOUND(-500,5000,5,-4,0)
950 FOR I=F+32 TO 608 STEP 32
960 CALL POKEV(I,160,"",I,Z)
970 NEXT I
980 C1=F-((INT(F/32)+1)*32-33)
```

```
990 IF C=C1 THEN 1010
1000 GOTO 420
1010 L=L+1
1020 CALL SOUND(-1200,110,5,-7,0)
1030 FOR I=1 TO 20
1040 CALL POKEV(771+(L*4),INT(RND*12)+4)
1050 NEXT I
1060 CALL POKEV(768+(L*4),0,0,0,0)
1070 SC=INT(SC*.8)
1080 GOSUB 1350
1090 IF V=3 THEN 1120
1100 V=V+1
1110 GOTO 390
1120 CALL POKEV(134,161,172,172,Z,164,165,166,165,174,164,165,178,179,
Z,167,175,174,165)
1130 GOTO 1150
1140 CALL POKEV(136,180,168,165,185,135,182,165,Z,172,161,174,164,165,
164)
1150 CALL POKEV(201,176,178,165,179,179,Z,161,Z,171,165,185)
1160 GOSUB 1320
1170 IF SC<H THEN 190
1180 H=SC
1190 GOTO 190
1200 RESTORE 220
1210 READ I1,I2,I3,I4,P1,Q
1220 GOTO 410
1230 FOR P=16*V TO 120 STEP 2
1240 CALL POKEV(765+(V*4),P)
1250 NEXT P
1260 CALL POKEV(654,Z,Z,Z)
1270 FOR P=183 TO 148 STEP -2
1280 CALL POKEV(764+(V*4),P)
1290 NEXT P
1300 CALL POKEV(654,202,202,202)
1310 RETURN
1320 CALL KEY(0,K,S)
1330 IF S=0 THEN 1320
1340 RETURN
1350 CALL POKEV(700,Z,Z,Z,Z)
1360 FOR I=1 TO LEN(STR$(SC))
1370 CALL POKEV(698+I,96+ASC(SEG$(STR$(SC),I,1)))
1380 NEXT I
1390 RETURN
1400 FOR I=1 TO LEN(STR$(H))
1410 CALL POKEV(682+I,96+ASC(SEG$(STR$(H),I,1)))
1420 NEXT I
1430 RETURN

1 SP=60 :: FOR D=1 TO 28 :: CALL SPRITE(#D,132,2,96,124,INT(RND*SP)-
INT(RND*SP),INT(RND*SP)-
INT(RND*SP))::  RANDOMIZE :: NEXT D :: CALL MAGNIFY(4):: CALL CLEAR
```

Listings

```
2 CALL CHAR(132,"060F0F06091060F0FF60000000000000000000000008060F0F0600
00000000000")
3 CALL CHAR(132,"000063FCF06808050303010000000060F0F06040404080C0C08
00000000000")
4 CALL CHAR(132,"60FFF0601009060F0F06000000000060F0F0608000000000000
00000000000")
5 CALL CHAR(132,"60F0FC632021211A3C3C1800000000000000060F0F060000000000
00000000000")
6 CALL CHAR(132,"060F0F06091060F0FF60000000000000000000000008060F0F0600
00000000000")
7 CALL CHAR(132,"000063FCF06808050303010000000060F0F06040404080C0C08
00000000000")
8 CALL CHAR(132,"60FFF0601009060F0F06000000000060F0F0608000000000000
00000000000")
9 CALL CHAR(132,"60F0FC632021211A3C3C1800000000000000060F0F060000000000
00000000000")
10 GOTO 2
```

```
1 SP=30 :: FOR D=1 TO 8 :: CALL SPRITE(#D,132,2,96,124,INT(RND*SP)-
INT(RND*SP),INT(RND*SP)-
INT(RND*SP)):: RANDOMIZE :: NEXT D :: CALL MAGNIFY(4):: CALL CLEAR
2 CALL CHAR(112,"060F0F06091060F0FF60000000000000000000000008060F0F0600
00000000000")
3 CALL CHAR(116,"000063FCF06808050303010000000060F0F06040404080C0C08
00000000000")
4 CALL CHAR(120,"60FFF0601009060F0F06000000000060F0F0608000000000000
00000000000")
5 CALL CHAR(124,"60F0FC632021211A3C3C1800000000000000060F0F060000000000
00000000000")
6 CALL CHAR(128,"060F0F06091060F0FF60000000000000000000000008060F0F0600
00000000000")
7 CALL CHAR(132,"000063FCF06808050303010000000060F0F06040404080C0C08
00000000000")
8 CALL CHAR(136,"60FFF0601009060F0F06000000000060F0F0608000000000000
00000000000")
9 CALL CHAR(140,"60F0FC632021211A3C3C1800000000000000060F0F060000000000
00000000000")
10 P=112
11 CALL PATTERN(#1,P,#2,P,#3,P,#4,P,#5,P,#6,P,#7,P,#8,P):: P=P+4 :: IF
 P=144 THEN 10 ELSE 11
10000 SUB DELAY :: SUBEND
```

THE MISSING LINK

```
1 DIM D(40):: IT=10
2 TPV=0 :: FOR I=1 TO IT :: READ D(I):: TPV=TPV+D(I):: NEXT I
3 DEF RAD(A)=A*PI/180
4 DG=360/TPV :: CD=0
5 FOR C=1 TO IT :: CALL LINK("PENHUE",C+1,3)
6 FOR I=CD TO CD+(D(C)*DG)STEP .5
7 CALL DRAW(106,128,106+(60*SIN(RAD(I))),128+(60*COS(RAD(I)))):: NEXT
I :: CD=CD+(D(C)*DG):: NEXT C
1000 CALL KEY(0,K,S):: IF S=0 THEN 1000
3000 DATA 67,53,2,4,10,200,130,15,4,56,22,76,23,54,66,4,5,4,2,45,3,8,4
```

```
20000 SUB DRAW(R,C,R2,C2):: CALL LINK("LINE",192/212*R,240/256*C,192/2
12*R2,240/256*C2):: SUBEND
```

```
1 CALL LINK("CLEAR")
2 DEF RAD(A)=A*PI/180
3 ROT=20 ! ROTATION ANGLE
4 XSTART=100 ! LEFT COLUMN OF
5 YSTART=60 ! TOP CORNER OF
6 FOR X=1 TO 72 STEP 4 :: FOR Y=1 TO 48 STEP 4
7 X2=XSTART+(X*COS(RAD(ROT))):: Y2=YSTART+(X*SIN(RAD(ROT)))
8 X2=X2+(Y*COS(RAD(ROT+90))):: Y2=Y2+(Y*SIN(RAD(ROT+90)))
9 CALL LINK("PIXEL",Y,X):: CALL LINK("PIXEL",Y2,X2):: NEXT Y :: NEXT X
1000 CALL KEY(0,K,S):: IF S=0 THEN 1000
```

THE MISSING LINK

NEW LOCATION

NEW LOCATION

```
1 DEF RAD(A)=A*PI/180
2 FOR Y=0 TO 180 STEP 1
3 R=155*SIN(RAD(Y))
4 FOR C=90 TO 270 STEP 10 :: CALL POINT3D(256+(R*SIN(RAD(C))),Y*2.2,20
0+(R*COS(RAD(C))):: NEXT C :: NEXT Y
10 CALL LINE3D(0,0,0,0,0,1215):: CALL LINE3D(0,424,0,0,424,1215):: CAL
L LINE3D(512,0,0,512,0,1215)
11 CALL LINE3D(512,424,0,512,424,1215)
12 CALL LINK("LINE",1,1,1,240):: CALL LINK("LINE",1,240,192,240):: CAL
L LINK("LINE",192,240,192,1):: CALL LINK("LINE",192,1,1,1)
500 CALL LINK("DUMP")
1000 CALL KEY(0,K,S):: IF S=0 THEN 1000
30000 SUB POINT3D(X2,Y2,Z2):: ZDIV=Z2*0.42 :: ZDIV2=Z2*.349 :: SX=512-
ZDIV :: SY=424-ZDIV2 :: DX=(512-SX)/2 :: DY=(424-SY)/2 :: R=424-DY-
(SY/424*Y2)
30001 C=DX+(SX/512*X2):: CALL LINK("PIXEL",192/424*R,240/512*C):: SUBE
ND
30009 SUB LINE3D(X2,Y2,Z2,X3,Y3,Z3):: ZDIV=Z2*0.42 :: ZDIV2=Z2*.349 ::
 SX=512-ZDIV :: SY=424-ZDIV2 :: DX=(512-SX)/2 :: DY=(424-
SY)/2 :: R=424-DY-(SY/424*Y2)
30010 C=DX+(SX/512*X2)
30011 ZDIV=Z3*0.42 :: ZDIV2=Z3*.349 :: SX=512-ZDIV :: SY=424-
ZDIV2 :: DX=(512-SX)/2 :: DY=(424-SY)/2 :: R2=424-DY-(SY/424*Y2)
30012 C2=DX+(SX/512*X3):: CALL LINK("LINE",192/424*R,240/512*C,192/424
*R2,240/512*C2):: SUBEND
```

THE MISSING LINK

```
1 CALL CHAR(140,"80"):: RANDOMIZE :: CALL SCREEN(2)
2 FOR D=1 TO 28 :: CALL SPRITE(#D,140,16,INT(RND*191)+1,INT(RND*255)+1
):: NEXT D:: FOR D=0 TO 14 :: CALL COLOR(D,16,1)
3 NEXT D :: CALL CLEAR
4 PRINT "  The stars are sprites  ":"":"Deep in the heart of Texas":""
:"":"":"":"":"":"":"":""
5 FOR D=1 TO 1000 :: NEXT D
6 FOR D=1 TO 28 :: CALL MOTION(#D,INT(RND*255)-127,INT(RND*255)-
127):: NEXT D
999 CALL SAY("PRESS+ANY+KEY")
1000 CALL CHAR(140,"FFFFFFFFFFFFFFFF"):: CALL KEY(0,K,S):: CALL CHAR(1
40,"80"):: IF S=0 THEN 1000
```

```
2000 CALL MAGNIFY(2)
2001 CALL SAY("TEN+NINE+EIGHT+SEVEN+SIX+FIVE+FOUR+THREE+TWO+ONE. THE+E
ND")
```

THE MISSING LINK

```
100 CALL LINE3D(60,30,Z,80,30,Z)
110 CALL LINE3D(80,30,Z,80,42,Z):: CALL LINE3D(80,42,Z,83,45,Z):: CALL
 LINE3D(83,45,Z,90,48,Z)
120 CALL LINE3D(90,48,Z,87,58,Z)
130 CALL LINE3D(87,58,Z,79,58,Z):: CALL LINE3D(79,58,Z,76,68,Z):: CALL
 LINE3D(76,68,Z,85,68,Z)
140 CALL LINE3D(85,68,Z,81,90,Z):: CALL LINE3D(81,90,Z,83,93,Z)
150 CALL LINE3D(83,93,Z,90,97,Z):: CALL LINE3D(90,97,Z,95,97,Z):: CALL
 LINE3D(95,97,Z,102,92,Z)
160 CALL LINE3D(102,92,Z,102,87,Z)
170 CALL LINE3D(102,87,Z,100,87,Z):: CALL LINE3D(100,87,Z,98,85,Z):: C
ALL LINE3D(98,85,Z,99,77,Z)
180 CALL LINE3D(99,77,Z,102,68,Z)
190 CALL LINE3D(102,68,Z,112,68,Z):: CALL LINE3D(112,68,Z,114,58,Z)
200 CALL LINE3D(114,58,Z,104,58,Z):: CALL LINE3D(104,58,Z,106,50,Z)
210 CALL LINE3D(106,50,Z,120,50,Z):: CALL LINE3D(120,50,Z,124,52,Z)
220 CALL LINE3D(124,52,Z,125,63,Z):: CALL LINE3D(125,63,Z,128,70,Z)::
CALL LINE3D(128,70,Z,129,80,Z)
230 CALL LINE3D(129,80,Z,103,102,Z)
240 CALL LINE3D(103,102,Z,102,105,Z):: CALL LINE3D(102,105,Z,102,110,Z
):: CALL LINE3D(102,110,Z,105,113,Z)
250 CALL LINE3D(105,113,Z,95,117,Z):: CALL LINE3D(95,117,Z,90,115,Z)::
 CALL LINE3D(90,115,Z,85,110,Z)
260 CALL LINE3D(85,110,Z,72,88,Z)
270 CALL LINE3D(72,88,Z,65,89,Z):: CALL LINE3D(65,89,Z,57,94,Z):: CALL
 LINE3D(57,94,Z,55,94,Z)
280 CALL LINE3D(55,94,Z,47,80,Z):: CALL LINE3D(47,80,Z,35,67,Z)
290 CALL LINE3D(35,67,Z,60,67,Z):: CALL LINE3D(60,67,Z,60,30,Z)
300 CALL LINE3D(93,53,Z,101,53,Z)
310 CALL LINE3D(101,53,Z,94,82,Z):: CALL LINE3D(94,82,Z,86,82,Z):: CAL
L LINE3D(86,82,Z,93,53,Z)
320 CALL LINE3D(99,32,Z,102,32,Z)
330 CALL LINE3D(102,32,Z,105,35,Z):: CALL LINE3D(105,35,Z,105,38,Z)
340 CALL LINE3D(105,38,Z,101,41,Z):: CALL LINE3D(101,41,Z,98,41,Z):: C
ALL LINE3D(98,41,Z,95,38,Z)
350 CALL LINE3D(95,38,Z,95,35,Z):: CALL LINE3D(95,35,Z,99,32,Z)
360 !ALL LINK("SAVEP","DSK2.SIGN2")
361 CALL KEY(0,K,S):: IF S=0 THEN 361
390 SUB LINE3D(X2,Y2,Z2,X3,Y3,Z3):: O=-
4 :: S=1.4 :: CALL LINK("LINE",O+(Y2*S),O+(X2*S),O+(Y3*S),O+(X3*S),2):
: X2,Y2,X3,Y3,Z2,Z3=0 :: SUBEND
```

```
1 DIM TYPE$(7):: FOR D=1 TO 7 :: READ TYPE$(D):: NEXT D
2 DATA DIS/FIX,DIS/VAR,INT/FIX,INT/VAR,PROGRAM,DIR,EMULATE
3 CALL FONT("DSK3.68FONT",6,8):: CALL DCOLOR(16,5)
```

```
1004 R,C=1 :: CALL WINDOW(80,20,140,240):: CALL LINK("PRINT",R,C,"Devi
ce.Pathname:"):: CALL LINK("INPUT",R,C,P$,40):: DEV$=SEG$(P$,1,5)
1005 CALL WINDOW(1,1,192,240):: CALL DCOLOR(2,7):: CALL LINK("PRINT",1
,1,"Richard Twyning's Advanced Disk Manager"):: CALL DCOLOR(2,11)
1006 CALL FONT("DSK3.57FONT",5,7)
1007 OPEN #1:DEV$,INPUT ,RELATIVE,INTERNAL :: INPUT #1:A$,J,J,K :: CLO
SE #1
1500 CALL LINK("PRINT",10,1,"Device Name:"&DEV$&"  Drive Name:"&A$)::
CALL FONT("DSK3.46FONT",4,6):: CALL LINK("PRINT",25,95,"Pathname:"&P$)
1501 CALL LINK("PRINT",19,1,"SECTORS USED:"&STR$(J-
K)&"    SECTORS FREE:"&STR$(K)):: CALL LINK("PRINT",25,1,"BYTES FREE:"
&STR$(K*256)):: CALL HEADER
1502 OPEN #1:P$,INPUT ,RELATIVE,INTERNAL :: INPUT #1:A$,J,J,K :: R=1
1503 INPUT #1:NAME$,A,B,C :: IF A=0 THEN CLOSE #1 :: CALL SAY("END+OF+
DATA"):: GOTO 15000
1504 IF A<0 THEN CALL DCOLOR(2,10)ELSE CALL DCOLOR(2,4)
1505 CALL LINK("PRINT",(R),1,NAME$&RPT$(CHR$(32),13-
LEN(NAME$))&TYPE$(ABS(A))&RPT$(CHR$(32),8-LEN(TYPE$(ABS(A)))))
1506 CALL LINK("PRINT",(R),92,STR$(C)&RPT$(CHR$(32),9-
LEN(STR$(C)))&STR$(B)&RPT$(CHR$(32),9-
LEN(STR$(B)))&STR$(G)&"/"&STR$(H)&"/"&SEG$(STR$(I),3,2)&"       ")
1507 !ALL LINK("PRINT",(R),204,STR$(M)&"/"&SEG$(N)&"/"&SEG$(STR$(O),3,
2))
1508 R=R+6 :: IF R>145 THEN CALL SAY("END+OF+SCREEN"):: GOTO 16000
1509 GOTO 1503
15000 CALL SAY("PRESS+E+TO+END+OR+R+TO+SEE+DEVICE+AGAIN+OR+D+FOR+A1+DI
FFERENT+DEVICE")
15001 CALL KEY(0,K,S):: IF S=0 THEN 15001
15002 IF K=69 THEN CALL SAY("FINISHED"):: END
15003 IF K=82 THEN GOTO 1006
15004 IF K=68 THEN 3
15005 GOTO 15000
16000 CALL SAY("PLEASE+PRESS+N+FOR+NEXT+SCREEN+OR+ANY+OTHER+KEY+TO+FIN
ISH")
16001 CALL KEY(0,K,S):: IF S=0 THEN 16001
16002 IF K=78 THEN R,C=1 :: CALL SAY("NEXT+SCREEN"):: CALL CLS :: GOTO
 1503 ELSE CALL SAY("FINISHED"):: END
25000 SUB FONT(A$,W,H):: OPEN #1:A$,VARIABLE 241,INPUT ,INTERNAL :: FO
R C=33 TO 128 STEP 15 :: INPUT #1:C$ :: CALL LINK("CHAR",C,C$):: NEXT
C
25001 CLOSE #1 :: CALL LINK("CHSIZE",W,H):: SUBEND
25002 SUB HEADER :: CALL LINK("PRINT",33,1,"FILE NAME     TYPE    LENG
TH   SECTORS  CREATED   UPDATED"):: CALL WINDOW(39,1,193,240):: SUBEND
25005 SUB DCOLOR(F,B):: CALL LINK("PENHUE",F,B):: SUBEND
25006 SUB CLS :: CALL LINK("PE"):: CALL LINK("FILL",1,1,192,240):: CAL
L LINK("PD"):: SUBEND
25007 SUB WINDOW(R,C,R2,C2):: CALL LINK("WINDOW",R,C,R2,C2):: CALL LIN
K("REVWIN"):: CALL CLS :: SUBEND
```

MACHINE CODE FROM CASSETTE - continued from Page 15.

```
       LI 1,PABCS
       LI 2,13
       BLWP @VMBW           * Set up cassette PAB to save
       LI 1,PAB+13          * 1st char after PAB must be
       MOV 1,@PNTR          * at pntr.
       LI 1,>0800
       MOVB 1,@>836D        * >836D must contain 8
       LI 0,PAB+10          * (DSR call)
       LI 1,FAC
       LI 2,3               * >8345 must contain name
       MOV 2,@PNTR-2        * len (3). FAC must contain
       BLWP @VMBR           * device name
       CLR @>83D0           * >83D0 must contain 0
       MOVB @>83D0,@STATUS  * Clear status byte
       BLWP @GPLLNK         * Branch to DSR
       DATA >3D
       RT
DISTAP MOV 11,@SAVRTN
       LWPI WS
       MOVB @LOAD,@PABDSK   * Prepare disk file for load
       MOVB @SAVE,@PABCS    * Prepare tape file for load
       BL @DISK
       LI 1,PABCS+6
       BL @CHANGE
       BL @TAPE
       JMP RETURN
TAPDIS MOV 11,@SAVRTN
       LWPI WS
       MOVB @LOAD,@PABCS    * Prepare disk file for load
       MOVB @SAVE,@PABDSK   * Prepare tape file for load
       BL @TAPE
       LI 1,PABDSK+6
       BL @CHANGE
       BL @DISK
RETURN CLR 0
       MOVB 0,@STATUS
       MOV @SAVRTN,11
       RT                   * Return
       END
```