Hardcore COMPUTIST's

Book Of Softkeys

Volume I

SoftKey Publishing

Welcome to the Book Of Softkeys, a publication devoted to the serious user of Apple][and Apple][compatible computers. The articles published in this volume detail the removal of copy protection schemes from commercial disks or contain information on copy protection and backup methods in general.

Our editorial policy is that we do NOT condone software piracy, but we do believe that honest users are entitled to backup commercial disks they have purchased. In addition to the security of a backup disk, the removal of copy protection gives the user the option of modifying application programs to meet his or her needs.

General Information:

Applesoft Disks (Softkey To) 9
Some general pointers on how to find Applesoft programs loaded by non-standard DOS disks.

Boot Code Tracing 22
There's no protecting against this method of disk cracking.

Boot Code Tracing Revisited 27
Take another look at how to trace a program as it loads into memory.

Demuffins 41
Make this handy disk cracking tool from a program supplied by Apple.

Diskedit 43
Read, Write and Edit sectors on any DOS 3.3 disk. It's easy with this program.

Diskview 84
A mini-nibbler that reads raw nibbilized data from any disk, regardless of format.

Getting On The Right Track 99
Here's how to tell what track your read/write head is positioned over. A real help on those difficult copies.

Hidden Locations Revealed 106
Take a peek at these favorite locations used by protected software.

(A Fix For) RANA Drive Owners 130
A way to boot code trace on a Rana drive.

Tricks & Bombs 139

Contents

Softkeys
Akalabeth 1
Ampermagic 4
Apple Galaxian (see Boot Code Tracing)
Aztec 12
Bag Of Tricks 13
Bill Budge's Trilogy 19
Buzzard Bait 35
Cannonball Blitz 37
Casino 38
Data Reporter 39
Deadline (see Zork I)
Disk Organizer II (see Hidden Locations Revealed)
Egbert II Communications Disk 89
Hard Hat Mack 101
Home Accountant 110
Homeword 112
Lancaster 113
Magic Window II 115
Multi-Disk Catalog (see Boot Code Tracing Revisited)
Multiplan 119
Pest Patrol 120
Prisoner II 129
Sammy Lightfoot 131
Screenwriter II 133
Sneakers 135
Spy's Demise 136
Starcross 137
Suspended (see Zork I)
Ultima][..... 141
Ultima][(2) 147
Visifile 149
Visiplot/Visitrend 151
Witness (see Zork I)
Wizardry 152
Wizardry (2) 155
Zork I, Zork II, Zork III 156

►Akalabeth

California Pacific Computers

Requirements:
Apple][48K
One blank disk
MUFFIN (from DOS 3.3 master disk)

By Bobby

Akalabeth is a hi-res adventure/maze/treasure hunt game distributed by California Pacific Computers. It has a few bugs that need correcting. Here is a method of ''down-loading'' Akalabeth from its protected diskette so that you can make the FIXes described in Softfix and additions.

1) Boot from the DOS 3.3 master disk

PR#6

2) Remove the master disk, insert the blank disk and enter the hello program

10 PRINT CHR$(4) ''RUN^I*************************I'' :REM THERE ARE 26 ASTERISKS**

3) Initialize the blank disk with the new hello program

INIT HELLO

4) Remove the initialized disk, insert the master disk and load MUFFIN

BLOAD MUFFIN

5) Make the following changes to allow MUFFIN to read the protected disk

POKE 4257,6
POKE 6664,222
POKE 6685,181
POKE 6742,217
POKE 6774,222
POKE 6795,173
POKE 6834,217

6) Now start MUFFIN and follow the prompts to copy Akalabeth. Use the initialized disk for the destination disk.

CALL 2051

6) To play the game, simply run the hello program.

Softfix & Additions

One of the reasons for removing programs and files from copy-protected disks is that you can now *fix* them, alter them, and even make *additions* to them. In other words, you can now customize them to fit your particular needs.

Since you have already "freed" Akalabeth from its "protected" disk, you can now fix its annoying scrolling problem and add a new magical command.

PROBLEM: The "hit points" of the foes you are fighting often flash (scroll) by so fast that you can't see what they were and therefore cannot make a valid combat decision.

FIX: Put in a pause after it prints the hit points. There are other minor fixes that modify screen format, greetings and farewells (Quit has been changed to eXit).

SPECIAL MAGICAL ADDITION: TELEPORTATION

To help the brave Magi descend into, and ascend out of, the forbidden depths of this World of Doom, we have added a special teleportation option. (Use only if you have 1 or more magic amulets because this option "burns up" amulets just as if you had used the Magic Ladder-Up or Ladder-Down commands.)

When you choose the 5th option: TELEPORT, you'll get: 1-UP 2-DOWN. Take your choice. If you choose UP you will continue upward until either you surface or you run out of amulets and get an: OUT OF MAGIC message. Choose DOWN and you'll be asked: HOW MANY LEVELS? It is a GET statement, so choose a number from 1 to 9 and don't bother to hit "return". If you run out of magic now, you're really in a World of Doom!

Here's how to add the teleport command to your deprotected akalabeth disk.

1) Load the file "MAIN PROGRAM"

LOAD MAIN PROGRAM

2) Enter the BASIC program on the next page.
3) Save the changed program back to the disk

SAVE MAIN PROGRAM

That's all there is to it. If you know of another *fix* or *addition* to Akalabeth or for any prepackaged programs on the market, (whether they are on protected disks or normal format disks), drop a note to SoftKey Publishing and we'll let other apple-users know about it.

BASIC program to add teleport option

```
1664 PRINT M$(MN ) " 'S^HIT^POINTS=" MZ%(MN ,1 ) : FOR QS = 1 TO 500 : NEXT
1682 PRINT "1-UP^^2-DN^^3-KILL^^4-???^^5-TELEPORT" : GET Q$ :Q = VAL (Q$ ) :
     PRINT Q : IF Q < 1 OR Q > 5 THEN 1682
1685 ON Q GOTO 1686 ,1690 ,1691 ,1692 ,1800
1800 VTAB 21 : CALL - 958 : PRINT "1-UP^^2-DOWN^" ; : GET Q$ :QQ = VAL (Q$ ) :
     PRINT QQ : IF QQ < 1 OR QQ > 2 THEN 1800
1810 ON QQ GOTO 1820 ,1840
1820 IN = IN - 1 : PRINT CHR$ (7 ) : IF IN = 1 THEN 1581
1822 IF PW(5 ) < 1 THEN PRINT "OUT^OF^MAGIC" : GOTO 1090
1824 IF RND (1 ) > .75 THEN PW(5 ) = PW(5 ) - 1
1826 GOTO 1820
1840 PRINT "HOW^MANY^LEVELS?^" ; : GET Q$ :QQ = VAL (Q$ ) : PRINT QQ : FOR QS
     = 1 TO QQ : IN = IN + 1 : IF RND (1 ) > .8 THEN PW(5 ) = PW(5 ) - 1
1844 IF PW(5 ) < 1 THEN QS = QQ : PRINT "OUT^OF^MAGIC"
1846 NEXT : GOTO 1090
60020 DATA "HIT^POINTS.." , "STRENGTH...." , "DEXTERITY..." ,
     "STAMINA....." , "WISDOM....." , "GOLD....."
60081 VTAB 11 : HTAB 18 : PRINT "X-EXIT"
60210 PRINT "WHICH^ITEM^SHALT^THOU^BUY^" ; : GET Q$ : IF Q$ = "X" THEN PRINT
     : PRINT "GOOD^LUCK" : FOR Z = 1 TO 1000 : NEXT : TEXT : HOME : RETURN
60237 VTAB 10 : HTAB 13 : PRINT C(5 ) "^^"
```

►Amper-Magic

Anthro-Digital

Requirements:
48K Apple or an Apple //e
Amper-Magic
One blank disk
Apple's COPYA program
Text file editor (AppleWriter II, Apple's EDASM, etc.)
A Disk Edit utility (THE INSPECTOR or WATSON.)
FIXCAT from "Bag of Tricks" and FID are also useful.

By Bob Bragner

Amper-Magic is a disk library of machine-language routines that can be easily attached to Applesoft programs thus providing extensions to BASIC such as PRINT USING, SWAP, DELETE ARRAY, INPUT ANYTHING and many, many more. The routines are connected to Applesoft through the ampersand "&" and it is easy to pass parameters. There is also a second disk of routines available dealing largely with screen formatting.

If you do any serious programming in Applesoft and find the language too slow for some applications but the thought of writing your own machine language routines to speed things up makes your head hurt, then Amper-Magic is for you.

This program is super-friendly and comes with a well thought-out loose-leaf manual. The price is a little steep, however. I paid $67 for my master and another $15 to be a "Registered Commercial Owner." Such registration entitles you to automatic notification in case the manufacturers add any corrections or improvements and also authorizes you to use the Amper-Magic routines in any commercial applications you may write. Having paid this one-time fee, your only other obligation is to mention Anthro-Digital's name in the documentation of any program using their routines. Fair enough. More than fair: generous.

However, I did balk at the $7 price tag on the backup disk. That's about $4 more than I'm willing to pay for such a necessity. But I like *lots* of backups, so I set about making them.

To my dismay I discovered that not only is Amper-Magic protected, it is protected in a very ingenious, and potentially dangerous, way. Actually, it is mentioned *nowhere* that the disk is protected and you are nowhere warned not to write anything onto the master disk. This is not friendly.

Amper-Magic has several levels of protection. You can copy the disk with Apple's COPYA without a hitch, but the result won't work. When you attempt to EXEC the main control textfile as directed, the disk drive turns on and stays on.

Hitting reset will lock up your machine. The only ways out are control/open Apple/reset or turn-the-machine-off-then-on.

An examination of the controlling text file called Amper-Magic showed, among other things, the following:

```
FF$ = "A" : FOR I = 1 TO 29 : FF$ = FF$ + CHR$(8)
: NEXT I
PRINT CHR$(4); "BRUN"FF$
DEL 1,0
RUN
```

For you newcomers, CHR$(8) is the backspace on your keyboard (⌫H). It's been so long since anyone used control characters to conceal filenames in catalogs that it never even occurred to me to look for them. This particular trick causes the filename to be written over by the next one in the catalog, thus rendering it invisible. Cute.

Changing the file's name to something more respectable (on the copy, of course), I proceeded to examine the binary file now simply called "A".

This is a 288-byte file that lives at $25B. The code is not difficult to disassemble, but it was doing some strange things. It appeared to look for 14 bytes in track 0, sector 0, and to compare them with a table in memory. If they matched, and if a number of other conditions were met, then another program called "AMPER.MAGIC PROGRAM" was loaded. Otherwise, program "A" hung up. Since program "A" did a jump to the standard DOS LOAD command, AMPER.MAGIC PROGRAM had to be somewhere in the catalog track (track $11) and it had to be in the VTOC. But it wasn't.

Call up WATSON or THE INSPECTOR and do a sector-use map of your Amper-Magic disk. Now look at sector $F of track $11 and backstep through the catalog. In sector $C you will see the "A" file whose name contains 29 inverse "H"s (it's at track $21, sector $08.

In sectors $B and $A you will see some deleted Applesoft files with odd names like NIL0 and NIL1 which seem to have been used to overwrite other deleted binary files with names like "REPEET" and "RWTS.O." They contain (meaningless?) data statements. When you get to sector $9, you will see that the link to the next catalog sector (8) is missing! Hmm... To DOS this means that this is the end of the catalog.

Backstep once more and all at once the words "AMPER.MAGIC PROGRAM" are staring at you from sector $8. This program appears to start at track $0F, sector $F. Check it out; it does.

Backstep some more. Notice that the link in sector $2 is missing. Now look at sector 1 and you will find yourself looking at what must be a VTOC! "But VTOC's are supposed to be in

sector 0," I hear someone say. I don't? Well, anyhow, there is a byte in DOS called READ/WRITE VTOC BUFFER. It is located at $B00D (45069) and it normally contains a 0.

Just for fun, try poking the value 1 there and type "CATALOG" with an ordinary disk in the drive. (For a lot of fun, poke in a number greater than 15!) Unless the disk has had a great many file names on it at one time, this track will usually be empty and your catalog will have disappeared. If any file names have been stored in this sector, CATALOG will display some quaint garbage since DOS will attempt to interpret what it finds there as a VTOC. Place your AMPER.MAGIC master in the drive, do a POKE 45069,1, then CATALOG and you will see the hidden file.

Returning to a more careful examination of the disassembled code of "A", it turns out that this program does indeed store a 1 at $B00D before it attempts to load the AMPER.MAGIC PROGRAM. The latter program, for its part, pokes a 0 back into that location so it can get at the routines stored on the disk. The reason this method of copy-protection is dangerous, aside from the fact that you don't know it is there, is that the normal VTOC at sector 0 may not know anything of AMPER.MAGIC PROGRAM. If it thinks the sectors it occupies are unused, and if you try to save something on the disk, DOS will cheerfully write all over the hidden program. *Moral: Never write anything to a master disk, even if the manufacturer doesn't tell you not to.*

Additional examination of "A" reveals that the whole routine can be bypassed. The program checks to see whether or not it is running on an original disk and whether or not an EXEC file is in operation. Finally, it doctors the VTOC and loads the hidden program. A quick examination of AMPER.MAGIC PROGRAM shows that it makes no attempt to protect itself once it is running.

Here is a step-by-step procedure to crack AMPER-MAGIC (the commands to type in are given in bold):

1) Copy the master disk using normal COPYA procedures

   RUN COPYA

2) Point DOS to the VTOC on sector 1

   POKE 45069,1

3) Catalog the disk

   CATALOG

4) Load the AMPER.MAGIC PROGRAM file

   LOAD AMPER.MAGIC PROGRAM

5) Unlock the AMPER.MAGIC PROGRAM file

UNLOCK AMPER.MAGIC PROGRAM

6) Delete the AMPER.MAGIC PROGRAM file

DELETE AMPER.MAGIC PROGRAM

7) Point DOS to the VTOC on sector 0

POKE 45069,0

8) Catalog the disk again

CATALOG

9) Save the AMPER.MAGIC PROGRAM file

SAVE AMPER.MAGIC PROGRAM

10) Unlock the EXEC text file AMPER.MAGIC

UNLOCK AMPER-MAGIC

11) Bring up a text file editor such as AppleWriter IIe, Apple EDASM, etc.
12) Load AMPER-MAGIC into the editor.
13) Insert the word "REM" at the beginning of the line that reads PRINTCHR$(4);"BRUN"FF$.
14) Insert the following:

CHR$(4)"LOAD AMPER.MAGIC PROGRAM"

before the last line in the file (the one that says "RUN").
15) Save this as a text file under the name AMPER-MAGIC

SAVE AMPER-MAGIC

16) Exit the editor.

You now have a de-protected copy of Amper-Magic from which you can make all the working backups you want using normal copy procedures.

You're not quite done yet, though, because the disk's catalog is still a bit messed up. To manually restore the missing links you can use WATSON/THE INSPECTOR (and zero out the extra VTOC at track $11, sector 1) or you can run the FIXCAT utility in "Bag of Tricks" and let it do the work for you.

You really *should* repair the catalog if you intend to use FID to move files off of, or onto, the deprotected disk. If you use FIXCAT you should ignore the temptation to restore the deleted files since most of them have been written over.

There is, however, a strange little Applesoft program not located at track $10, sector $E (its track/sector list is in sector $F). Restore this program and call it "WEIRD HELLO", then run it for an odd message.

By the way, Volume 2 of Amper-Magic is unprotected and can be copied without any fooling around. I like to FID all its binary files over to the deprotected master since both disks are mostly empty space anyhow.

Do you want to add more routines to the library? Move everything to a hard disk or a Ram Pseuodisk? Eliminate the annoying beeps in the main program? With your unprotected version of Amper-Magic you are now free to make any modifications you wish.

►Softkey To Applesoft Disks

By Bobby

If the program you have is working to your satisfaction, there is really no reason to go through the trouble of "unlocking" the copy-protection. I recommend that everyone obtain a bit-copy program and use it to backup their software. The methods described here are for programs that you feel need FIXing. In order to FIX them, you have to be able to list them.

Another reason for putting programs on normal DOS is to conserve disk space by placing more than one program on a disk. If you just make a bit-for-bit backup of ten disks, you now have 20 disks. However, by "downloading" the protected program to normal DOS, you can probably put all ten on two or three one-sided disks.

The Open-Heart Surgery Method

Requirements:
Apple][+ 48K
Applesoft in ROM
Integer card
Tape recorder
One blank initialized disk (3.2 or 3.3 as appropriate)

This method is not for beginners. It requires some knowledge of programming and involves a number of monitor commands. An understanding of Zero Page locations is helpful.

No matter what has been altered, this method will work because the computer must know the program location in order to RUN it. The following locations apply to Applesoft in ROM and 48K DOS. They are used by the computer to tell it where the program is located and what to do with it. Multibyte addresses are given in standard format (e.g. hex lo-byte, hi-byte).

$D6 is the RUN flag. Any time this byte has the high bit set, the program in memory will auto-run.

$3F2, $3F3 is the reset vector. (See page 37 of your Apple][+ Reference Manual (A][RM.)

$3F4 is the power up byte (EOR of $A5 and the value at $3F3. See page 37, A][RM.)

$67, $68 is the start-of-program pointer. See page 140 of the Applesoft BASIC Programming Manual(AB-PRM).

$AF, $B0 is the end-of-program pointer. See page 141, AB-PRM.

$9DBF (CALL-25153) reconnects DOS. See page 144 of your DOS 3.3 Manual (DOSM).

$A851 (CALL-22446) reconnects the input hooks. (Bypasses $9DBF and any time-bombs that may have been planted there.)

$AA60, $AA61 is the length of the last loaded program. See page 144, DOSM.

$AA72, $AA73 is the start of the last BLOADED program. See page 144, DOSM.

The following steps were written for an Apple][+ 48K with Applesoft in ROM and an Integer card. If you have Integer in ROM and an Applesoft card, be sure to reverse the appropriate steps (i.e. when it says to flip the switch UP on your Integer card, flip the switch DOWN on your Applesoft card). Hitting RETURN after commands is implied and will only be referenced in certain lines for clarity.

1) Boot the backup copy of your program disk (never use the original).
2) Flip the Integer card switch UP and press RESET to enter the monitor.
3) Check the start of program pointer. If the number is not $801, then write it down for later reference.

67.68

4) Reset the run flag.

D6:0

5) Change the reset vector to jump into the current language.

3F2:03 E0 45

6) Flip the Integer card switch DOWN, press RESET and type

LIST

If the program does not list, you may be trying to list a binary file. Check $AA72,AA73 to see if this is true.
7) Save your program to tape.
8) Take a good look at your listing. Write down the names of any files that are LOADed or RUN and the start address of any binary file, if given. List all POKEs and CALLs.
9) On some protected disks the command parser in DOS is changed. This tends to wipe out some of the common commands (e.g. LOAD, SAVE, CATALOG). Another popular trick is to change DOS so it does not allow any direct commands. In order to load and save the files that make up your program, select the first line entry that LOADs or BLOADs a file. DELETE all line entries above and below the selected line (e.g. you want line 5,

so DELETE lines 0 through 4, and 6 through 63999).
10) Now

CALL -25153

If it bombs, restart. Repeat all steps up to 10 and now

CALL -22446

This reconnects the DOS. Then type

RUN

This will load your selected file.
11) Save the file to tape and repeat these steps until all files are SAVEd.
12) Boot normal DOS. LOAD the files one at a time from tape and SAVE to your disk.
13) Examine all the Applesoft listings to make certain that all the files have been transferred.

Now that all the files are on normal DOS, examine them for hidden bombs. Bombs are program lines that serve no purpose other than to garbage the program. See "Tricks and Bombs".

For Integer Programs

The zero page pointers for Integer programs are:

	HEX	DEC
Start of program	$CA, $CB	202, 203
End of program	$4C, $4D	76, 77

These pointers tell your computer where the program is in memory. The hex address is in normal lo-byte, hi-byte format.

Hope these tips will help you find your program. Good luck!

►Aztec

Datamost

Requirements:
Apple][48K
One blank disk
CopyA from DOS master disk
Disk edit program

By Marco Hunter

Here is a quick softkey.

1) Use the modified COPYA from Zork softkey.
2) Edit track 00, sector 03, change byte 42 from 38 to 18.

That's it.

►Bag Of Tricks

Quality Software

Requirements:
Apple][,][+, //e or compatible
Blank disk initialized with 48K slave DOS
Bag of Tricks disk

By Neil Taylor, Earl Taylor and Ray Darrah

Have you ever booted the Bag of Tricks disk and received an irritating message to use the original, when it's already in the drive? Have you ever wanted to avoid the menu and skip right to the needed program? Perhaps you are afraid of crashing the original and can't get a good copy. Here is an easy (albeit somewhat long) way to get an unprotected version.

Basic Procedure

To unprotect the programs on the original disk, each one will have to be loaded by its DOS and then saved by a normal DOS.

The programs loaded by the Bag of Tricks DOS are located at $800 in memory which normally is overwritten during the boot process. Before they can be saved, they must be moved to a safe area of memory. The programs can then be run by normal DOS.

Loading and Saving

The following procedure for loading and saving TRAX is used in a slightly different form for each of the remaining Bag of Tricks programs: INIT, ZAP, and FIXCAT.

TRAX

1) Boot the 3.3 master, insert the blank disk and type

   FP
   INIT HELLO

2) Boot the Bag of Tricks disk (the menu will be displayed).
3) After the light goes off open the drive door.
4) Press reset once, wait a couple of seconds and press it again.
5) To enter the monitor

   CALL -151

6) Then type

   9489:4C 59 FF

7) Close the drive door.
8) Type

9400G

9) To load TRAX, type

T

10) Then type

3800<800.2AFFM

11) For Trax only, type

6700<8700.93FFM

12) Place the blank disk into the drive and boot it with

C600G

13) Now

BSAVE TRAX,A$3800,L$2300

14) And for TRAX and INIT only

BSAVE TRAX.SUP,A$6700,L$D00

The same format can be used for INIT, ZAP, and FIXCAT with changes in Steps 9, 10, 13, and 14. Step 11 is not necessary. Complete Steps 2 through 8 for each of the remaining programs, then follow the special steps listed under the program title.

Complete INIT first:

INIT

9) To load INIT type

I

10) Then type

3800<800.325EM

11) And

BSAVE INIT,A$3800,L$2B00

12) Place the blank disk into the drive and boot it with

C600G

14) Then

BSAVE SUPPLEMENT,A$7600,L$A00

ZAP

The supplement is the same for INIT, ZAP and FIXCAT, so Step 14 can be eliminated.

9) To load ZAP type

Z

10) Then type

5000<800.4CFFM

12) Place the blank disk in the drive and boot it with

C600G

13) Then

BSAVE ZAP,A$5000,L$4500

FIXCAT

9) To load FIXCAT type

F

10) Then type

4800<800.1FFFM

12) Place the blank disk in the drive and boot it with

C600G

13) And

BSAVE FIXCAT,A$4800,L$1C00

To get the picture, complete Steps 2 through 4. Then boot the backup. When the Applesoft cursor is displayed ( ]), type

BSAVE PICTURE,A$2000,L$2000

FIXPRG3

The last step is a fix for the SUPPLEMENT program.

15) Once again boot the original Bag of Tricks disk.
16) When the menu appears, open the drive door, press reset, wait a second and press reset again.
17) Enter the monitor and move the patch to a safer location.

CALL - 151
5400<9400.96FFM

18) Change the program so that it will work at this new location

5485:55
5517:55
5530:55
5542:56
554A:56

19) Insert the blank disk and boot it

C600G

20) Save this patch program

BSAVE FIXPRG3,A$5400,L$300

21) Change the HELLO program to the following and you're done!

Hello Program

```
10 TEXT : HOME : HIMEM: 25600
20 IF PEEK (104 ) = 96 THEN 50
30 POKE 103 ,1 : POKE 104 ,96 : POKE 24576 ,0
40 PRINT CHR$ (4 ) "RUN^HELLO"
50 A = PEEK ( - 16384 ) - 128 : IF A = 70 OR A = 73 OR A = 84 OR A = 90 OR A = 69
     THEN 100
60 POKE - 16368 ,0
70 HTAB 10 : VTAB 10 : PRINT "LOADING^MENU..."
80 PRINT CHR$ (4 ) "BLOAD^PICTURE,A$4000" : POKE - 16299 ,0 : POKE - 16297
     ,0 : POKE - 16302 ,0 : POKE - 16304 ,0
90 IF PEEK ( - 16384 ) < 128 THEN 90
100 A = 0 :A$ = CHR$ ( PEEK ( - 16384 ) - 128 ) : POKE - 16368 ,0
110 IF A$ = "T" THEN A$ = "TRAX" :A = 1 : GOTO 170
120 IF A$ = "Z" THEN A$ = "ZAP" : GOTO 170
130 IF A$ = "I" THEN A$ = "INIT" : GOTO 170
140 IF A$ = "F" THEN A$ = "FIXCAT" : GOTO 170
150 IF A$ = "E" OR A$ = CHR$ (27 ) THEN TEXT : HOME : END
160 GOTO 90
170 TEXT : HOME : VTAB 11 : HTAB (13 + LEN (A$ ) ) / 2 : PRINT "LOADING^" A$
     "..."
180 D$ = CHR$ (4 )
190 IF A = 1 THEN PRINT D$ "BLOAD^TRAX.SUP,A$8700" : GOTO 210
200 PRINT D$ "BLOAD^SUPPLEMENT,A$7600"
210 PRINT D$ "BLOAD^" A$ ",A$800"
220 PRINT D$ "BLOAD^FIXPRG3,A$5400"
230 POKE 47016 , PEEK (43 ) : POKE 38079 ,A : CALL 21635
```

Getting Into The Program

An alternate method would be to boot code trace the DOS.

The boot process of Bag of Tricks is relatively simple but tedious, especially since it would have to be done five times (once for each program and once for the picture).

That problem can be bypassed by taking advantage of an oversight by the authors. When reset is pressed the Apple tries to boot because the power-up byte is not set correctly. This is the byte that tells the Apple when it has been turned on. (See page 37 of the Apple][+ Reference Manual). When the power-up byte is set improperly the Apple will try to boot regardless of the address pointed to by the reset vector. When reset is hit from the menu the Apple acts like it has just been turned on and tries to boot. When reset is pressed the second time the Apple is put into Applesoft.

Loading The Programs

In the sixth step of the save/load procedure the three bytes 4C 59 FF represent the machine language opcodes which tell the computer to jump to the routine that causes it to stop and enter the monitor (acting like a stop from Applesoft). Now after the DOS has loaded any of the programs, control will be given to the user, not to the program.

Saving To Normal Disk

The program is now in memory and the Apple is under control with the modified Bag of Tricks DOS in the machine. Unfortunately, it is far from normal and has no convenient SAVE or BSAVE. What now? Save it to tape? Perish the thought; a normal DOS can be rebooted.

Since the booting process uses page 8 ($800-$8FF) in memory, which is exactly where the program starts, a special routine in the Apple's monitor is used for moving memory out of the way. It simply transfers the part of memory which the program resides in byte by byte from one place in memory to another. By moving the programs higher in memory they are put in a safe area not used by the boot. That is what Steps 9 and 10 are for. Once the program is moved, the backup disk can be safely booted.

Backup Files

There should be nine files on the backup now: TRAX, TRAX.SUP, INIT, SUPPLEMENT, ZAP, FIXCAT, PICTURE, FIXPRG3 and HELLO. The HELLO program is simply a menu that allows the backup to imitate the original disk. The picture is the same as the one on the original disk.

The other seven files make up the four major Bag of Tricks programs (the other files are routines). Each program is in two parts, a main section and a supplement, but the supplements for INIT, ZAP and FIXCAT are the same. To run any of these programs, the accompanying supplement must also be loaded. To use TRAX, TRAX.SUP must be loaded first. For the other three programs, SUPPLEMENT must be loaded first.

How To Run The Programs

Because the programs were moved before they were saved, they will be loaded into the wrong spot if just BRUN or BLOADed. To make sure everything is in the right place, DOS has to be told where to place the program. FOR EXAMPLE: To run TRAX, first load in the supplement with BLOAD TRAX.SUP,A$8700. This loads the supplement into the correct place in memory. Then the TRAX program can be run with BRUN TRAX,A$800.

Similarly, the supplement for INIT, ZAP and FIXCAT would be BLOAD SUPPLEMENT,A$7600. To run the program: BRUN INIT,A$800 (ZAP or FIXCAT can be substituted for the title INIT).

Final Analysis

All four Bag of Tricks programs are extremely useful. ZAP is an excellent disk editor with convenient help pages. It also has definable commands (a nice touch). INIT is the program that you needed to convert all your disks to DOS 3.3. It allows reinitialization without loss of data. FIXCAT is great for doing all of those tedious chores related to recovering crashed disks.

There is only doubt about TRAX. Its sole use seems to be looking at the protection schemes on disks (it gives a great output for users of IOB). However, TRAX will not analyze the Bag of Tricks disk. If the authors couldn't figure out how to analyze their own protection schemes, TRAX can't be all that good. On the other hand, maybe it was deliberate. Maybe the authors are trying to say, "Break and copy other disks, but not ours!"

►Bill Budge's Trilogy Of Games

California Pacific

Requirements:
48K Apple][Plus
BOOT13 (from DOS master disk)
Trilogy of Games
A blank diskette

By Michael Decker

One of Bill Budge's earliest offerings was his Trilogy of Games: Driver, a rudimentary driving-skills game; Pinball, a rudimentary you-guessed-it; and Space Wars, a (I won't say it) two-player space battle.

This old, DOS 3.2 disk still sells, and Space Wars remains one of the most entertaining arcade-style games in which two players can directly battle each other. Most people often prefer it to newer, much more sophisticated games in which one battles the computer. I was motivated to de-protect the game by a slight bug (one player's ship is more affected by gravity than the other ship) and by my annoyance with the game's DOS 3.2 format.

Inside Budge

I first tried cracking the disk. Protection was simple: changes in the prologues/epilogues. However, it looked like direct disk addressing was used. Ugh.

So, I booted with an Inspector/BASICS disk, then booted Trilogy. At the menu I reset out, then looked memory over: picture at $4000; program at $6000. Hmm.

I then booted DOS and saved picture and program. Next, I restarted the program (6000G) and, in turn, loaded each game. I found the entry points and saved the games. Next, I examined the main program and identified the transition between the menu and the disk access routines. Finally, I wrote an Applesoft program to handle the game switching. Presto! The Transparent Budge!

Doing It

1) Boot the DOS 3.3 System Master.

   PR#6

2) Prepare to boot 13-sector DOS

   BRUN BOOT13

3) Insert the Trilogy disk and press RETURN.
4) Hit ESC to get to menu.
5) Remove the disk and press RESET.
6) Press RESET again.
7) Boot the 48K slave disk.

PR#6

8) Save the picture first

BSAVE PICTURE, A$4000,L$2000

9) Enter the monitor

CALL -151

10) Make this modification

67B7:4C D2 D7

11) Save the first 8 pages of this modified program

BSAVE ATTRACT, A$6000,L$800

12) Restore the original program

67B7:20 00 6D

13) Insert Trilogy disk and re-start the game.

6000G

14) Hit ESC to get to menu.
15) Type 1 to select Driver, the first game in Trilogy.
16) When the title and/or instructions come up, hit RESET.
17) Swap disks and save the just loaded program

BSAVE DRIVER,A$800,L$1801

18) Enter the monitor again

CALL -151

19) Repeat Steps 13-18 for PINBALL and SPACE WARS using the same BSAVE parameters.
20) Coldstart BASIC and DOS

FP

21) Type in the following BASIC menu "HELLO" program.

```
10 ON PEEK (104 ) = 112 GOTO 20 : POKE 103 ,1 : POKE 104 ,112 : POKE 28672 ,0
    : PRINT CHR$ (4 ) "RUNBUDGE.HELLO"
20 PRINT CHR$ (4 ) "BLOAD^ATTRACT"
30 PRINT CHR$ (4 ) "BLOAD^PICTURE"
40 POKE 10 ,76 : POKE 11 ,0 : POKE 12 ,96 : PRINT USR (0 ) : CALL - 10621
50 D$ = CHR$ (13 ) + CHR$ (4 ) : VTAB 1 : ON PEEK (67 ) - 3 GOTO 60 ,70 ,80
60 PRINT D$ "BLOAD^DRIVER" : CALL 3523 : RUN 40
```

```
70 PRINT D$ "BLOAD^PINBALL" : CALL 2048 : RUN 40
80 PRINT D$ "BLOAD^SPACE^WAR" : CALL 6015 : RUN 40
```

22) Save it

SAVE BUDGE.HELLO

I would sometimes get an ?OUT OF MEMORY ERROR. If you should encounter this, just type **RUN 20** and you'll be fine.

Now, would someone tell me how to make both spaceships feel the same gravity?

►Boot Code Tracing

By Bobby

Requirements:
Apple II
One disk drive with Apple controller
Apple Galaxian
Empty 48K slave disk
Knowledge of machine code/assembly language

Boot code tracing is the most difficult of all the softkeys presented. It is also the most effective method of transferring single load binary programs, those which load into the Apple at Boot and do not access the disk again. Therefore, be warned that this softkey is definitely not for beginners. You must have some knowledge of machine code or assembly language.

The initial Boot or Boot 0 is determined by a program on the disk controller card. This program is stored in ROM (Read Only Memory) and cannot be changed by the program on a disk. A non-standard format may be used on a disk to prevent copying, but that disk will not Boot on your Apple unless track 0, sector 0 is readable by the disk controller card. This means that you can also read it and, by controlling the boot process, you can determine where the program is and save it to disk.

In order to demonstrate this process, the Boot of the binary program Apple Galaxian will be traced. This is a familiar game and almost everyone owns a copy.

The Boot 0 code is at $C600. If your controller card is not in slot 6, then change the number after the $0C to correspond to the appropriate slot (i.e. Slot 5 would be $C500). First the code will be moved down into RAM (Random Access Memory) where a portion of it can be modified. Turn on your Apple, press RESET to halt the boot, then enter the monitor

CALL -151

And type

9600<C600.C6FFM

This will move the Boot code to page $96 ($9600), where the changes will be made.

NOTE: Commands will be on a separate line and printed exactly as you should enter them. Press return after each line entry. If a command has already been listed, it will be referred to but not listed again.

Be sure you move the code to a page boundary that corresponds to the slot that your controller card is in (i.e. for slot 6 - $9600, $8600 etc. or for slot 5 - $9500, $8500 etc.).

The reason for this is that the Boot 0 code contains a routine that finds which slot the controller card is in. It does this by calling a return code in the F8 ROM and extracting the return address to locate the page boundary. The code itself is relocatable (will run anywhere in memory).

The purpose of Boot 0 is to transfer the code stored on disk at track 0, sector 0 into memory and to execute it. Then the disk code (Boot 1) will take over the Boot process. Here is where the first change will be made.

Examine the code at the end of page $96. At $96F8 you will find a JMP to $801. This is the next Boot stage (Boot 1). Boot 0 needs to load and not run the Boot 1 code at page $08, so the code at $96F8 will be changed to JMP to the monitor after turning off the drive motor. In order to save having to reenter the same code, put the routine at $9500.

96FA:95 N 9501:AD E8 C0 4C 59 FF

The base address $C088 is used to turn the drive motor off. You must add the slot number of your controller card to this address in the form $s0 where "s" is the slot (i.e. slot 5 would be $C088 + $50 = $C0D8). If you're not used to hexadecimal numbers, there is a table on page 82 of the Apple][+ reference manual with the base addresses and conversions for each slot.

After making the changes and checking that they are correct, you are ready to begin. Run the code at $9600 (Boot 0).

$9600G

When the drive stops, Boot 1 will be in memory at page $08. If you examine the code at $800 you will see that it is written to run at page $02. The first part of the code is a move routine that transfers the code from page $08 to page $02, then JMPs to page $02.

Boot 1 should be moved to page $98 so you can make changes. The code must be moved or else the next time you run Boot 0, it will be overwritten.

9800<800.8FFM

Now the modified Boot 0 can be linked at $9600 to the Boot 1 code at $9800. The move routine should then be changed so it will work at its new address, and the JMP to the next Boot stage should be changed to the routine at $9500.

96FA:98 N 9805:98 N 9843:95

The "N" is used as a null command to separate changes. It is the monitor command to set normal mode and does nothing, since you are already in normal mode.

After you have made the changes and checked that they are correct, run the code at $9600 again. When the drive stops, Boot

2 will be in memory at page $03. Move the code at $300 to $9300.

9300<300.3FFM

The exit from Boot 2 is via an indirect JMP at $9343. This JMP normally points into itself. Rather than write any additional code to check when this JMP is changed, allow the code at $300 to be called as a subroutine and change the indirect JMP at $9343 to point to $9501. This works because the JMP at $9343 is not seen until Boot 3 is completely loaded.

Link Boot 1 to Boot 2 and run Boot 0 again.

9343:4C 01 95 N 9843:93 N 9600G

Boot 3 is now in memory. Location $93CC holds the page minus 1 of the start of Boot 3. You should find a $B6 there. That means that Boot 3 starts at page $B7 or $B700 in memory. This is the final Boot. This stage will load the main program.

Boot 3 is large and would be cumbersome to modify if moved. It can remain right where it is and the Boot 2 code can be changed so that next time it will load in a different location. The page number that Boot 2 uses when it loads Boot 3 from page $B6 to page $D6 will be changed.

9313:A9 D6 EA

This will cause Boot 2 to try to load the Boot 3 code into the space occupied by the monitor. Since the monitor is in ROM (Read Only Memory), nothing will change and the Boot 3 code at $B700 is protected.

At $B749 is a routine that garbages the Boot 3 code after it loads in the program. At $B759 is a JMP to $600. This is the actual start of the program. Since $600 is in the text page, the boot with the code can't just be stopped at $9501. If this were done, the code on the text page would scroll or be over-written. The code needs to be moved up to some safe place in memory. Also, the end of the program is at $A000 (my guess), which is the same place that DOS resides on a normal disk.

The Galaxian Logo is on HIRES page 1 ($2000-3FFF). It is reasonable to assume that this is a safe place and that no code exists there. The logo will be lost, but the memory is needed.

The following code is a routine that compresses memory by moving page $00 thru page $08 up to page $20, and moving page $40 thru page $9F down to page $29.

B000:A2 00 BD 00 40 9D 00 29
B008:E8 D0 F7 EE 04 B0 EE 07
B010:B0 AD 04 B0 C9 A0 90 EA
B018:A2 00 BD 00 00 9D 00 20
B020:E8 D0 F7 EE 1C B0 EE 1F

B028:B0 AD 1C B0 C9 09 90 EA
B030:4C 59 FF
B000.B032

After entering the code, link Boot 3 to it and link Boot 2 to Boot 3.

B749:4C 00 B0 N 9343:4C 00 B7

Check to see that all the changes are correct, then run Boot 0. When the drive stops you should see a lot of inverse and flashing characters on the screen. This is the portion of the program that is loaded into the text screen area. An image of this code is safely stored at $2000.

Remove the backup copy of Apple Galaxian and insert the 48K slave disk in the drive. Boot the disk and enter the monitor. There are a few more changes to make before the file can be BSAVEd.

The binary program that you are going to save is 132 sectors long. DOS will not normally allow you to save a file this long, so change the range limitation in DOS from 32K to 64K.

A964:FF

When the slave DOS was Booted, it over-wrote the code on page $08. An image of the page $08 code was saved at $2800. Move this code down to page $08.

800<2800.28FFM

Now all that is left is to enter the routine that will move the program back to where it will run. This routine also disconnects DOS and selects the hi-res screen before it JMPs to $600.

2800:A2 00 BD 00 88 9D 00 9F
2808:E8 D0 F7 CE 04 28 CE 07
2810:28 AD 04 28 C9 29 B0 EA
2818:BD 00 20 95 00 BD 00 21
2820:9D 00 01 BD 00 22 9D 00
2828:02 BD 00 23 9D 00 03 BD
2830:00 24 9D 00 04 BD 00 25
2838:9D 00 05 BD 00 26 9D 00
2840:06 BD 00 27 9D 00 07 E8
2848:D0 CE 20 89 FE 20 93 FE
2850:AD 50 C0 AD 57 C0 AD 52
2858:C0 4C 00 06

Add a JMP at $7FD to the move routine, and you are ready to BSAVE the file.

7FD:4C 00 28
BSAVE GALAXIAN, A$7FD, L$8103

Now that it is safely stored on the disk, you can run it and discover how much of the memory that was saved is really used. More often than not, all of memory is not used. A large part of what was saved is not required by the program. BLOADing the file and erasing pages before you run the program is the simplest way to determine what sectors are necessary. You could determine if there is sufficient memory that is not used and retrace the Boot code in order to save the HIRES picture. This is a fine point that is not required and is left up to the reader.

►Boot Code Tracing: Revisited

By Mycroft

Requirements:
Knowledge of machine language
48K Apple][with Integer Card
Multi-Disk Catalog by Sensible Software
One blank initialized disk

If you have a little knowledge of machine language programming, and a good measure of perseverance, this article will help you to defeat the locking scheme used in a large group of programs (those that boot up and run without subsequent disk access) and let you capture them on standard DOS. Most games and many utility and business programs fall into this category.

The Theory

The basis for this approach is: *No matter what protection scheme is used, the program must boot on a standard Apple in order to run.* If we could somehow step through the boot process, get everything loaded, and then stop just prior to going to the start of the program, we would be able to save the whole thing and run it under standard DOS.

The APPLE Boot process starts with Boot 0 in the Disk Controller ROM. This short machine language program BLOADS track 0, sector 0 (containing Boot 1 of the disk being booted) at locations $800 thru $8FF, and then jumps to $801 to execute Boot 1. Boot 1 reads Boot 2, and the process continues through successive Boot stages until finally the main program is loaded and run.

Assuming your disk controller card is in slot 6, the code for Boot 0 starts at $C600 and extends through $C6FA. If you power up your APPLE, enter the monitor and do a "C600L", the beginning of the disassembly listing of Boot 0 can be seen. If you type a few more L's you will be able to see the jump to Boot 1 at $C6F8.

What we would like to do is execute Boot 0, but stop before jumping to Boot 1. But, how is this done?

Reset

The RESET routine is at $FF59 in the monitor ROM. It performs a function similar to pushing the RESET button. If called, a RESET cycle is performed and any executing program will be stopped. If we could get Boot 0 to jump to $FF59 instead of $801, we will have accomplished our first objective.

Modifying Boot 0

Since Boot 0 is in ROM, it cannot be directly modified. The solution is to move it to RAM using the monitor's memory move routine so we can change it to suit our needs. The new location should be somewhere in RAM where it will not be overwritten in successive Boot stages. Memory that is just below DOS is usually safe to use, since many locked programs use only slightly modified versions of normal DOS.

Because of the routine in Boot 0 that finds the slot the Disk Controller is in, the second digit of the address we move Boot 0 to must be the same as the slot number. So let's use $9600-$96FF.

The First Step

From the monitor, type

9600<C600.C6FFM

to move Boot 0 and, instead of jumping to $801 at the end, have it jump to RESET by entering

96F8:4C 59 FF

Now put a program disk in drive 1 and execute the modified Boot 0 by typing

9600G

The drive will start, and in a second or two you should hear a beep and see the monitor prompt on the screen. Turn off the drive by typing

C0E8

Now you can have a look at Boot 1 by listing from $801 to see what it does

801L

This process can be repeated for each successive stage in the Boot process. Whenever there is a jump out to a new code section, put in good old 4C 59 FF (JMP to RESET). You can examine this code at your leisure. Don't worry about the code at this point. Look mainly for JMP's out.

A Practical Example

To illustrate the procedure, I will use the program "Multi-Disk Catalog III", by Sensible Software. This program is an excellent and very useful utility (which I would recommend you purchase and add to your library.) Because I have examined dozens of

other programs which use a virtually identical Boot sequence, I am sure they can be unlocked using this same technique with only a few changes (try one of your own once-load programs if you don't have Multi-Disk Catalog). You'll need an initialized slave diskette and make sure there is a write-protect tab on the disk you are trying to unlock.

Unlocking Multi-Disk Catalog III

BOOT 0

Turn on your APPLE with the disk drive empty and push RESET to stop the drive. This will keep the APPLE's memory clear. Insert the locked disk and type

CALL -151

Type

9600<C600.C6FFM

to move Boot 0. Then fix the jump out by typing

96FA:98

This changes the jump out to $9801 where, in the next step, we will be moving Boot 1. At $9801 type

9801:4C 59 FF

so we can stop the Boot. Now type

9600G

After the beep, type

C0E8

to turn off the drive.

BOOT 1

Look at Boot 1 by typing

801L

This code relocates itself to memory page two, loads Boot 2, and jumps out to $301 at $841. Move this code so it can be modified, by typing

9800<800.8FFM

Fix the jump out to go to $9301 by typing

9843:93

and stop it at that point with

9301:4C 59 FF

One other byte in Boot 1 must be changed so that our modified code is executed properly. Type

9805:98

Now do a

9600G

once again, and type

C0E8

to stop the drive.

BOOT 2

The next stage of the Boot normally starts at $301. Move this code by typing

9300<300.3FFM

Take a look at the disassembled listing of the code beginning at $9301. The JMP out of this stage can be seen at $9343, but it is disguised by being an in direct JMP through page 0 location $3E.

If you examine the code in this Boot stage beginning at $931F, you will find that this indirect jump is used repeatedly to go to $25D, but ultimately, the indirect jump address is changed to go to the next Boot stage. This change occurs at $933A-$9341.

The final jump is determined by the byte stored in memory location $3CC, which the program increments by 1 before executing the final indirect jump. If you look at byte $3CC

$3CC

you will find that it contains value $36 (other programs commonly use $B6 here). This is the high byte of the jump-to address (the low byte has value $00).The program increments this value by 1, so the final JMP address is to $3700.

What we want to do is let the Boot do all the jumps when it is going to $25D, but stop it before it makes the final jump out to $3700.

Handling The Indirect Jump

Because zero page location $3E contains the value $5D for all the indirect jumps except the final one, we can put in a subroutine which checks to see if this value changes and, if so, stops the boot.

Enter

9000:A9 5D C5 3E D0 03 4C 5D
9008:02 4C 59 4C 59 FF

The source code for this routine would look like

```
9000-A9 5D      LDA #$5D        Load value.
9002-C5 3E      CMP $3E         Same?
9004-D0 03      BNE $9009       No, go RESET
9006-4C 5D 02   JMP $025D       Yes, go on.
9009-4C 59 FF   JMP $FF59       Jump RESET.
```

Change the Boot code to jump to this subroutine by typing

9343:4C 00 90

and do another

9600G

BOOT 3

At the beep, you can stop the drive (C0E8) and examine the code beginning at $3700 looking for the next jump out. It is at $3747, and is a jump to $1B03. So, as before, change this jump by typing

374 7:4C 59 FF

Writing To The ROM

The code we moved to memory page $93 ($9300) was responsible for reading in this portion of the Boot. But since we just made a change at $3747, we don't want it to be over-written when we start the Boot over again. What we do is change byte $93CC so that a dummy write is done by letting it "write" to the ROM!

93CC:D0

and also changing bytes $9315 and $933E to reference this location instead of $3CC. Type

9315:93
933E:93

The "write" of the next Boot stage; therefore, begins at $D000, and is ineffectual except to keep the drive running and in the proper read mode. Change the subroutine we put in at $9000 to go to the modified next stage by typing

9009:4C 00 37

Now type

9600G

one last time. This time when you hear the beep, the drive will stop by itself.

Start listing the program at $1B03, looking for the next major jump out. You should find it at $1C25, and it is a jump to $1E54. Type

1C25:4C 59 FF
1B03G

Now list beginning at $1E54. There is an immediate jump to $9D84. List from $9D84.

Language Card?

At $9DE4 and $9DE7 are two indirect jumps, through $9D5E and $9D5C, respectively. Examine the code carefully, beginning at $9D84, and you will find that the first indirect jump is taken by systems equipped with language cards (RAM cards), and the second for those without. No matter; the second indirect address will ultimately be jumped to whichever system you have. To find out what it is, type

9DE7:4C 59 FF
9D84G

When you hear the beep, type

9D5C.9D5D

and the screen will display (low byte first) the address indirectly jumped to as $33D5. Begin listing from $33D5 and you should find the next JMP way down at $34BC; it goes to $00FD. Once again, type

34BC:4C 59 FF
33D5G

The disk drive will start and the last segment of the program will be loaded in. If everything worked correctly you should hear a beep, the drive will stop, and the screen will display garbage.

Where The Program Starts

Normally, the program would next jump via the page zero location we just changed at $34BC to the start of the multi-disk catalog main program. Type

00FDL

to see where the start is.

The software protectors have put one last obstacle in our path. $00FD takes an indirect jump through page zero locations $4E and $4F to the start of the program. We can't examine these locations to find out where the jump goes because they get changed when a RESET cycle is executed. Not to worry, though, because if you type

348FL

you can see that locations $4E and $4F are set from $33C0 and $33C1, respectively. Typing

33C0.33C1

will thus divulge (low byte first) the starting address of the main program as $1294.

The program occupies memory from $800-$18FF, $5000-$5CFF, and $9D00-$BFFF. You find this out by scrolling through memory to try and identify program statements and data, often a trial and error process. If you get too much, no real harm is done, but too little and the program will not run.

All that remains to be done is to capture the program under normal DOS.

Moving The Memory

Warm Booting a slave diskette will over-write memory locations $800-$8FF and $9600-$BFFF, but everything from $900-$95FF will be unaffected. To move the "lower" part of the program ($800-$1800) up and out of the way of the Boot, and adjacent to the "middle" part, type

3F00<800.18FFM

Similarly, move the "top" part of the program down by typing

5D00<800.BFFFM

Type the following relocation routine, when the program is BRUN, everything will return to its proper place:

```
3ED0:00 00 A9 5D 85 3D A9 7F
3ED8:85 3F A9 9D 85 43 20 F3
3EE0:3E A9 3F 85 3D A9 4F 85
3EE8:3F A9 08 85 43 20 F3 3E
3EF0:4C 94 12 A0 FF 84 3E C8
3EF8:84 3C 84 42 20 2C FE 60
```

The source code for this routine looks like:

```
3ED2- A9 5D      LDA #$5D      SET UP
3ED4- 85 3D      STA $3D       ADDRESS DATA
3ED6- A9 7F      LDA #$7F      FOR MEMORY
3ED8- 85 3F      STA $3F       MOVE ROUTINE
3EDA- A9 9D      LDA #$9D      FOR TOP OF
3EDC- 85 43      STA $43       PROGRAM.
3EDE- 20 F3 3E   JSR $3EF3     'MOVE' SUBR
3EE1- A9 3F      LDA #$3F      DO IT AGAIN
3EE3- 85 3D      STA $3D       FOR 'BOTTOM'
3EE5- A9 4F      LDA #$4F      PART OF PROG
3EE7- 85 3F      STA $3F
3EE9- A9 08      LDA #$08
3EEB- 85 43      STA $43
3EED- 20 F3 3E   JSR $3EF3
3EF0- 4C 94 12   JMP $1294     PROG START
3EF3- A0 FF      LDY #$FF
3EF5- 84 3E      STY $3E
3EF7- C8         INY
3EF8- 84 3C      STY $3C
3EFA- 84 42      STY $42
3EFC- 20 2C FE   JSR $FE2C     MONITOR MEM
3EFF- 60         RTS           MOVE
```

The Final Test

Now remove the protected disk from the drive, replace it with a normal DOS (slave) disk and type

6⊖P

(Hold the ⊖ key down and press "P", then release the ⊖ key and press RETURN). When the Boot is complete, type

BSAVE MDC,A$3ED2,L$412E

Your unlocked program will now BRUN normally and can be customized as you see fit.

Try this procedure with your other "one-shot" load programs. You will probably be surprised at how often it works.

Page zero locations changed by RESET:

$20-$2B
$31
$33-$3F
$40-$49
$4E-$4F

►Buzzard Bait

Sirius Software Inc.

Requirements:
48K Apple, with old F8 monitor ROM
One disk drive with DOS 3.3
Initialized 48K Slave DOS 3.3 disk
Buzzard Bait

By Clay Harrell

Sirius Software always provides us with games that are challenging both in play and protection. Buzzard Bait is no exception. If you try copying the disk with your favorite nibble copier, you will find that the people at Sirius have done their homework in discovering ways to defeat you (but we have come to expect that from this fun-loving bunch).

Not being one who enjoys watching the bytes go by for hours with a copier, I tend to think there is a better way. Although the Sirius people have gone to great lengths to protect their disk from the bit bunch, they failed to protect the memory to any great extent. *(A Note for Replay-Wildcard owners: Sirius hasn't forgotten you either! Just enough disk access has been put in to discourage any easy copies).*

Once the game is done with its load and the little red light goes out, RESET should be the next key pressed and the monitor prompt should appear.

Snooping through memory and checking all the "standard" starting locations reveals that an 8000G will start the game up just as if nothing happened! Further examination of memory reveals that Buzzard Bait lives from $800 to $9800.

Now all we must do is move the portions of memory that get destroyed in a Slave disk, boot to a safe location and save the game as a BLOADABLE file. Hi-res page one is a perfect candidate for this since it gets re-drawn upon starting the game and, therefore, does not need to be saved.

We must also defeat the disk access that occurs between all levels. This access does not load any data, but just checks to see if the disk is present.

In cookbook fashion, here is what we must do:

1) Boot Buzzard Bait.
2) Reset into monitor after the drive stops.
3) Move the code from $800 through $1000 up to $2000

2000<800.1000M

4) Move the code from $9600 through $9800 down to $3000

3000<9600.9800M

5) Boot a 48K normal DOS 3.3 Slave disk

6⊖P

6) Reduce the number of DOS buffers to one

MAXFILES1

7) Enter the monitor

CALL -151

8) Move the code at $2000 through $2800 back down to $800

800<2000.2800M

9) Move the code at $3000 through $3200 back up to $9600

9600<3000.3200M

10) Save the first chunk of code

BSAVE BAIT2,A$4000,L$5800

11) Make two patches that bypass the disk access between levels

7FD:4C 00 20
2000:A9 18 8D B5 B7 A9 60 8D
2008:B6 B7 4C 00 80

12) Save the second chunk of code

BSAVE BAIT1,A$7FD,L$1811

13) Enter the following Applesoft program:

```
1 HIMEM:16284
2 D$ = CHR$(4)
3 PRINT D$ "MAXFILES1"
4 PRINT D$ "BLOAD BAIT2"
5 PRINT D$ "BRUN BAIT1"
```

14) Save the Applesoft program

SAVE BUZZARD BAIT

This softkeyed version of Buzzard Bait you have created is not an exact copy of the original because the backup does not have any sound effects. To me this is an acceptable tradeoff for the security of not having to wear out my original game disk. Perhaps with the information I have provided, someone out there can produce a softkey procedure that retains those annoying sound effects we have all come to love.

►Cannonball Blitz

Sierra On-Line, Inc.

Requirements:
Apple][+ or equivalent
COPYA
A sector editor
Cannonball Blitz
One blank disk

By Staff

Here is a short APT for Cannonball Blitz which will reduce the hazards encountered on the second level of play. After finishing Level 1, just press the space bar and the repeat key simultaneously (or press the space bar continuously if you have automatic repeat) until the screen changes to the next level. When play begins at the second level, the number of cannons will have been reduced to only two.

And a Quick Softkey. . .

To copy the entire disk, use COPYA. Then, using a sector edit program such as DiskEdit, read Track 17, Sector 0E, and change address CD from 49 to 60. Finally, write the sector back to the disk. This backup copy can be copied using any of the numerous copy programs on the market. To run the program, simply boot the disk.

►Casino

By Leonard Nadel, DDS

To unlock the disk Casino so it can be accessed and backed-up with COPYA, use the same method as for Zork. (See table of contents.) No changes in the sector mode are necessary!

►Data Reporter

Synergistic Software

Requirements:
48K Apple][+
COPYA
Data Reporter
One blank disk

By Don Halley

The Data Reporter, from Synergistic Software is advertised as Version 2 of the popular modifiable database system. It is basically a data storage and retrieval system with graph plotting capabilities, a text editor, and many data management features.

Documentation for Data Reporter is fairly complete, although it suffers from the same unimaginative approach to organization as does the documentation for its competitors. There is no index and the table of contents offers no help beyond one or two-word references to program features. A tutorial section would be appreciated by the uninitiated user, and a reference table containing pointers to key sections would help.

Normal Copy

The documentation suggests that a copy of the original disk be made for general use in order to prolong the original's life. The COPYA program on the DOS System Master may be used, but it will encounter a read error on the last track. This track has been written with a modified DOS and its contents are read into memory via a short machine language program appended to the last line of the HELLO program. This means that you must always boot from the original, then swap to your application disk for processing.

Unprotected Copy

A little PEEKing around will reveal that the protected sectors are from $00 to $06 on track $22, and that the information contained there is loaded into memory from $9400 to $9AFF. Examination of the HELLO program shows that it does not touch this area upon exit. This means that both a way of reading the protected portion of the disk into the proper memory locations (HELLO) and a clean exit have been provided.

Here's the step-by-step procedure:

1) Make a copy using COPYA. (Ignore the read error.)

2) RUN the HELLO program on the original disk.
3) Choose the QUIT option from the primary menu.
4) Replace the original disk with your copy.
5) Type these commands:

BSAVE HELLO.OBJ, A$9400, L$06FF
LOCK HELLO.OBJ
UNLOCK HELLO
63999 PRINT D$ "BLOAD HELLO.OBJ" : RETURN
SAVE HELLO
LOCK HELLO
PR#6

You now have a fully operational backup for only the cost of the disk itself. Of course, you may make as many additional backups as you like from this disk.

►Demuffin

By Bobby

Requirements
Apple][,][+, //e with 48K
One disk drive
Blank initialized disk
DOS 3.3 Master disk with MUFFIN
Programmers Aid ROM

Muffin is a program on the 3.3 DOS Master disk. It is used to transfer 13-sector files to 16-sector disks. To accomplish this, it contains an image of 13-sector RWTS (Read or Write a Track and Sector). It uses this internal RWTS to read the file and then writes to your diskette using the external or resident DOS.

Demuffin is created by changing the jumps in the program so that it uses the resident DOS to read and the internal RWTS image to write. Also, the internal RWTS is changed from a 13 sector image to a 16 sector image.

1) Boot the DOS 3.3 Master disk

   PR#6

2) Switch to Integer and load MUFFIN

   INT
   BLOAD MUFFIN

3) Enter the monitor and initialize the Programers Aid Code-Relocation feature

   CALL -151
   D4D5G

4) Tell the relocate routine what we're moving and where it goes

   1900<B800.BFFF⊖Y*

5) Move the first Code segment down to $1900

   1900<B800.BA10⊖Y

6) Move the data segment

   .BC57M

7) Move the last code segment

   .BFFF⊖Y

8) Make the following patches

   1155:00 1E

115B:D9 03
1197:A0 20
15A0:A0 D2 C5 D3 C9 C4 C5 CE
15A8:D4 A0 C4 AE CF AE D3 AE
15F7:C4 C5
20A0:A9 1E 8D B9 B7 20 FD AA
20A8:48 A9 BD 8D B9 B7 68 60

9) Save the new DEMUFFIN program.

BSAVE DEMUFFIN,A$803,L$1900

Directions & Explanations

Demuffin directions are identical to Muffin's. You want to convert the files, so you have to select the disk slot and drive and the file name you want to convert. It is helpful to type = for the file name so that all the available file names will be displayed when you answer yes to the question: "Do you want prompting?". Now you can choose which files to convert (transfer).

If a file doesn't transfer and you get an I/0 ERROR, you'll be returned to the menu. Just repeat all the steps but don't bother converting the files you have already converted, and *bypass the problem file* (it probably isn't needed by the program anyway). Continue to convert as many files as you can.

►DiskEdit

By Charles Haight

Certain tools are required to understand DOS and to manipulate disk files. The first is a nibbler or bit editor. The second and most important of these is a sector editor.

DiskEdit is one such utility.

DiskEdit is a user oriented direct disk access program. Simply stated, DiskEdit allows the user to read or write any sector on a disk. This means that the user can:

Directly edit files on disk.
Change text in binary files.
Insert illegal characters in REMs.
Directly alter data base files.

Move sectors (even between disks).
Repair crashed disks.

Format catalog names.
Remove illegal codes in file names.
Write flashing and inverse titles.
Repair the VTOC.
UnDELETE deleted files.
Hide file names.

DiskEdit will display an entire sector as hexadecimal and ASCII.

The keyword in DiskEdit is simplicity. The commands are single key entry (you don't have to keep hitting return). With DiskEdit you can directly enter control, inverse, flashing and lower case characters. Input and display information can be in hex or decimal. The shimmering cursor is easy to identify even with a screen full of inverse and flashing characters. You can jump the cursor to any absolute position within a sector. The NEXT and LAST commands allow you to single-step through track/sectors. And DiskEdit has a simple escape. If you change your mind, pressing the escape key will set the defaults and return you to the command mode.

Disk Overview

Before we begin entering DiskEdit, let's take a closer look at DOS and a normal disk.

The flexible (or floppy) diskette can be thought of as a disc-shaped piece of recording tape, and essentially that's all it is. A flat disk shape is used, instead of a flat strip (as in a tape), in order to maximize the rate of data transfer. For instance, to transfer data to and from a tape, the computer would have to READ all of the tape preceding the area where the data was stored before it could transfer the required data. This method of

information retrieval is known as "sequential access" and is about the same as scanning a cassette tape for a favorite song.

The disk, on the other hand, is set up in such a way that the computer can go directly to a piece of data or program by scanning the disk laterally. This method of information retrieval is known as "random access" and is similiar to selecting a particular song on a record.

Before a disk can be used, it must be formatted. The INIT command is used for this purpose.

When a disk is initialized, the Disk Operating System (DOS) writes 35 concentric tracks. Each track is divided into 16 blocks called "sectors". (DOS version 3.2 writes only 13 "sectors".) Each sector contains an address mark and a data mark. These marks start and end with a unique pattern of bytes.

The address mark tells the DOS what track/sector it is currently reading. It contains the volume, track, sector and checksum information. The data mark contains the actual data. It tells the DOS where the data begins and ends and includes a checksum that is used to verify the accuracy of the data.

If you have ever tried to load a program and the disk drive started making a slight chatter, chances are that the DOS could not read one of these markers. It then recalibrates the read/write head by moving it back to track zero and stepping (counting each track that it passes over) back out to where it was supposed to be.

The tracks are numbered from $00 (0) to $22 (34) and the sectors from $00 (0) to $0F (15). Tracks $00 through track $02 (a total of three tracks; zero, one and two) contain the DOS program.

The DOS gives the Apple the ability to manipulate data on a diskette. In this program are all of the commands related to controlling the disk drive (i.e. CATALOG, INIT, LOAD...) and a set of ERROR messages which, unless you either are a magician or don't use the Disk II, you have probably seen before.

The disk controller card that connects the Disk II to the Apple also has a small program on it. When you boot a disk, this program tells the Disk II to read track $00 (0), sector $00 (0) (remember, we start counting at zero instead of one) into memory.

The program on track $00, sector $00 contains the information required to read in sectors $00 through $09 on track $00. The program on sectors $00-$09 reads in the remaining information on track $00-$02. When this process is completed, the entire operating system (DOS) will be in memory.

At this point, DOS takes over and runs the "HELLO" program. The program that was used to initialize a disk is usually refered to as the hello or greeting program.

In order to find your "HELLO" program, DOS goes to the Volume Table of Contents (VTOC) and Directory located on track $11 (17). The VTOC and Directory are used by DOS whenever you read or write to the disk. The VTOC or "bit map" shows which sectors are in use and which are free. The second and third byte of the VTOC point to where the directory starts.

The Directory begins on sector $0F (15) and continues down to sector $01 (1). The second and third byte of each directory sector point to the next available sector. If these two bytes are zero, then there are no more sectors. The Directory contains a list of all the files on the disk. Each entry contains a pointer to the track/sector list, a file status (locked/unlocked) code, a file type code (1 letter), the file name (30 characters) and the file size. The track/sector list is a list of track/sector pairs that are used to store that program. This is why saving a blank file always takes two sectors. One for the blank file and one for the track/sector list.

DOS will read the VTOC which will point to the directory. DOS then finds the program name in the directory and finds where the track/sector list is. DOS then loads all of the track/sector pairs into the proper memory locations. Finally, DOS transfers control to the resident BASIC (Applesoft?) which will run the program.

Entering the Program

Enter the machine code portion of DiskEdit first. Save it to disk as ED.OBJ.,

BSAVE ED.OBJ, A$800, L$A21

Enter the BASIC listing and save it to disk as ED.BAS.

SAVE ED.BAS

Bload the binary file.

BLOAD ED.OBJ

Type "RUN" and press return. After the "?UNDEF'D STATEMENT ERROR" message, run ED.BAS.

RUN ED.BAS

This will combine the two programs to form DiskEdit.

Type 'X' to exit to BASIC. Now, insert a blank disk in the drive and type 'INIT DISK EDIT'. Use this back up copy for the following examples and ALL other uses.

Getting Familiar

This exercise will aid you in understanding how to use the commands by taking you on a tour of a normal DOS diskette.

Please read each paragraph before pressing any keys and follow the directions carefully.

Insert the DiskEdit back-up disk in Drive 1. Turn on your computer. DiskEdit will prompt you when it is ready.

Press any key to start.

What is your status?

On the bottom of the screen are the status indicators and prompts. They tell you the slot (SL), drive (DR), track (T), sector (S), volume (V), byte position (B), filter (F) and data entry mode currently selected.

Reading

Press the 'R' key. This tells DiskEdit that you want to READ a sector from the disk. A flashing prompt will appear next to the track (T) indicator. DiskEdit is asking you what track to read.

Type '01'. This tells DiskEdit that you wish to read track $01 (1). The flashing prompt will move over to the sector (S) indicator. Respond to this prompt by typing '8'.

The disk drive should whirr for about two seconds, and then stop. The screen should be full of numbers and letters. You are now looking at the contents of track $01 (1), sector $08 (8) in what is known as hex or hexadecimal format on the left side of your screen and ASCII on the right side.

Hex a what?

Hexadecimal is a base sixteen numbering system. It gets its name from the fact that it contains all of the numbers found in normal base 10 (decimal 0-9) plus six alphabetic characters (A thru F).

Say 'AS-KEY'

ASCII stands for "American Standard Code for Information Interchange." This is the alphanumeric equivalent of all of those hex symbols on the right.

Error messages

The sector you are now viewing ($08) contains the DOS error messages (they are continued on sector $09).

Press the 'N' key. This will increment the sector count and cause Diskedit to read the next sector. If the sector count had been at $0F (15), the track count would have been incremented by one and the sector count reset to $00 (0).

The "Boot" Program

You are now viewing the sector where the "Boot" program name is stored. In the center of the screen is the file name 'DISK EDIT'. This is the name of the program that the DOS

will automatically 'RUN' when this disk is booted. (If you decide later to change the boot program name on this disk, this is where you should come.)

Let's follow how DOS located the file "DISK EDIT" when you booted this disk.

Press 'R' to read. Type '11' for the track and '0' for the sector.

You are looking at the VTOC or bit map. The second and third byte point to the first directory (catalog) sector. These bytes should be '11 0F'.

Press 'R' and type '11' for the track and 'F' for the sector.

The sector you are viewing is the first part of the directory, which extends downward to sector $01 (1). Press the zero key. This is a special function key designed to make viewing catalog sectors more meaningful. The screen will return to normal when you press any other key.

Moving the cursor

The I, J, K and M keys are the cursor movement keys. The cursor has a wrap around feature. If you go off the screen on one side, you will come back on the opposite side.

Press the 'O' key. The flashing prompt will appear next to the byte position (B) indicator.

This command allows us to move the cursor to a specific location on the screen. Move the cursor to the beginning of the file name by typing '0E'. The cursor should now be in front of the 'D' of "DISK EDIT".

Move the cursor back one character by pressing 'J'. Look at the hex portion of your screen. The '02' is used by DOS to tell what type of program DiskEdit is and whether it is locked or unlocked. The '0' means that the file is unlocked. The '2' means the file is Applesoft.

Editing

Press the 'E' key. This tells DiskEdit that you wish to edit the sector.

Type '82'. Press 'ESC' to exit the EDIT mode. Press the 'O' key. Type '2C'. The byte you are looking at and the '00' following it are the hex equivalent of the sector use count for the file. Press the 'E' key. Type '00'. Press 'ESC' to exit the EDIT mode.

Press the zero key.

The program HELLO is shown with an asterisk. Changing the '02' into a '82' locked the file. Entering the '00' will change the sector count for the file to zero.

Writing

WARNING: Read the following paragraph completely before you press any keys.

Up to this point, you have only been editing the disk information that is in the computer's memory. In order to make the changes permanent you need to WRITE this information back to the disk.

The command to do this is 'W' for WRITE. Press the 'W' key. Press 'RETURN' for the track (T) and sector (S).

When the RETURN key is pressed in response to a prompt the program will act as if the default values were entered. The default values for the track and sector are the last track/sector that was read or written.

The program will beep and a warning will be printed. This is your last chance to change your mind. You must press RETURN to have DiskEdit write to your disk. Any other key will abort this operation.

Press RETURN. The buffer contents are now written to the disk. Press the 'C' key to see the catalog. The first file will be locked (indicated by the asterisk '*' next to the file type) and the sector count will be '000'. Press any key to continue.

This completes the exercise. Experiment with DiskEdit using this same scratch diskette.

Summary of Commands

ESC This is the "I changed my mind" key. Press this key to reset defaults and exit back to the command mode.

RTN The RETURN key, when used to answer an input prompt, will accept the current default and continue. (Example: When prompted for the track and sector during a read command, pressing RETURN twice will cause the current track and sector to be read.)

> Track skip command. Increments the track number and performs a READ. Does not increment the sector.

< Track skip command. Decrements the track number and performs a READ. Does not decrement the sector number.

A Sets character entry mode to ASCII

B Disassemble buffer command. Calls the monitor to disassemble buffer contents starting at the cursor location. Use the space bar to continue disassembly one line at a time or press RETURN to disassemble 20 additional lines. Press 'P' to print the screen display. (Press ESC to exit.)

C Displays the disk catalog using the current slot and drive. Prints the number of free sectors on the disk.

D Flips the active drive from 1 to 2 or from 2 to 1 on each keypress.

E A continuous-edit mode, this mode allows you to type changes just like on a typewriter. Pure cursor movement is supported using control keys. If you are in hexadecimal format, only valid hex digits are accepted as input. In ASCII format all keys are valid except the control keys listed below. (Press ESC to exit.)

Ctrl Key	Function
F	set FLASH mode
I	set INVERSE mode
N	set NORMAL mode
Q	move cursor up
Z	move cursor down
→	move cursor right
←	move cursor left

+ This edit submode is entered using the plus (+) key. The '>>EDIT<<' prompt is changed to '++EDIT++'. It is identical to the normal edit mode except that it does not support control functions. All keys are valid except ESC. Control characters may be directly entered. The plus (+) key or the semi-colon (;) may be used to enter this submode.

F This is the filter format command it allows you to change the filter values so that you can configure your own filters.

G Turns the sound on or off each time you press the 'G' key. (Default at BOOT is on.)

H Sets character entry mode to Hexadecimal

I Moves cursor up.

J Moves cursor left.

K Moves cursor right.

M Moves cursor down.

L Reads last sector.

N Reads next sector.

O Allows cursor to be jumped to any absolute position in the displayed sector.

P Sends the buffer contents to your printer. A header is printed first which shows the track, sector, and volume. When first used, the program will ask which slot your printer is using and whether you wish to use 40 or 80 columns.

R Prompts you for the track and sector to read. Use the RETURN key to accept default values.

S Prompts you for a new slot. Valid entries are from 1 to 7.

U Toggles the status indicators between hex and decimal and updates the display information. Only the track, sector, and cursor are affected by this key. (Default at BOOT is hex.)

W Prompts you for the track and sector to write to. Use the RETURN key to accept default values. After entering the track

and sector, DiskEdit will beep and pause. This is your last chance to change your mind. Press RETURN to WRITE, or any other key to escape.

X Clears the screen and exits to BASIC.

ASCII Filters

The number following the filter (F) indicator is the filter currently selected.

There are 9 filters. Each affects the format of the displayed screen contents. They do not change the actual buffer contents in any way. They may be selected by pressing the corresponding number (1-9) key.

Rolling your own

The filters can be modified from the keyboard. Select a filter (1-9) by pressing the appropriate number key. Press the 'F' key.

The 256 screen characters are divided into 8 blocks. The prompt under 'BLOCK' indicates the original group of characters while the prompt under 'CHG:' indicates what characters will be displayed on the screen.

The first prompt is 'INV1' for inverse letters. Press '7'. This causes all inverse characters in block 1 to display as normal. Block 7 is normal letters. The 'INV1' prompt under 'CHG:' will change to 'NOR2'. By pressing a number from 1 to 8, each of the original blocks can be changed to display as any other block. Pressing 'RETURN' will skip a block.

Next to 'CHG:' is 'FN#'. The ''FN#' is short for function number. There are 3 functions.

1. Print block, delete one character
2. Delete block, print one character
3. Delete entire block

Customizing the Program

DiskEdit is an Applesoft program with packed machine code. This means that the machine code portion of the program is hidden in such a way that DOS thinks it is part of the Applesoft program.

The machine code is hidden behind the REM in line 0 rather than at the end of the BASIC program. This was done in order to allow program modification while keeping the program size as small as possible.

If you load the program and list it, you will see a single BASIC line:

0 CALL 2167 : GOTO 10 : REM

In order to make changes you will need to follow these steps:

1. RUN the program.
2. When the copyright notice is on the screen, press RESET to exit the program.
3. LIST the program and make changes.
4. After making any changes, RUN the program and exit using the "X" key. This will change the zero page pointers so that DOS can save the machine code along with the modified program.
5. SAVE the modified program to disk.

DiskEdit BASIC program

```
10 TEXT: HOME: GOSUB 2150: GOTO 750
20 REM CLEAR TEXT WINDOW
30 POKE 35,21: HOME: RETURN
40 REM GET CHARACTER WITH PROMPT
50 POKE - 16368,0
60 GET N$:KY = ASC (N$) + 128: IF KY < > 155 THEN RETURN
70 REM RESET ALL DEFAULTS
80 POKE TR,TS: POKE SC,SS: POKE CM,RD:TK = TS:SE = SS: CALL TT: CALL MV
90 REM CLEAR STACK, GOTO CMD PARSER
100 CALL - 10621: GOTO 750
110 REM MAKE NOISE AND RETURN
120 PRINT G$G$;: RETURN
130 REM FIND BINARY START
140 IF PEEK (1024) = 164 THEN 190
150 REM FOR DECIMAL NUMBER
160 A1 = PEEK (1024) - 176:A2 = PEEK (1025) - 176: IF A2 > - 1 THEN GOSUB
    400:A1 = KY:A2 = PEEK (1026) - 176: IFA2 > - 1 THEN GOSUB 400: RETURN
170 KY = A1: RETURN
180 REM FOR HEX NUMBER
190 KY = PEEK (1025): GOSUB 280:A1 = KY:KY = PEEK (1026): GOSUB 280:A2 =
    KY:KY = A1 * 16 + A2: RETURN
200 REM GET KEY WITHOUT PROMPT
210 KY = PEEK ( - 16384): IF KY <128 THEN 210
220 POKE - 16368,0: RETURN
230 REM HANDLE AN ERROR
240 A1 = PEEK (EF): GOSUB 30: VTAB12: HTAB 12: IF A1 = 16 THEN PRINT
    "UNABLE^TO^WRITE": GOTO260
250 PRINT "DISK^DRIVE^ERROR"
260 PRINT G$G$;: FOR X = 1 TO 1000: NEXT: POKE EF,0: POKE 35,24: CALL MV:
    GOTO 80
270 REM PROCESS HEX/DEC INPUT
280 KY = KY - 176: IF KY < 0 OR KY > 22 THEN KY = 128: RETURN
290 IF KY > 9 THEN KY = KY - 7: IFKY < 10 OR KY > 15 THEN KY =128
300 RETURN
310 REM GET HEX OR DEC ONLY
```

```
320 GOSUB 50
330 IF KY = 141 THEN RETURN
340 GOSUB 280
350 IF KY = 128 THEN GOSUB 120: GOTO 320
360 IF PEEK (HF) AND KY > 9 THEN GOSUB 120: GOTO 320
370 RETURN
380 REM CALCULATE HEX/DEC NO.
390 IF NOT PEEK (HF) THEN KY =A1 * 16 + A2: RETURN
400 KY = A1 * 10 + A2: RETURN
410 REM GET TRACK VALUE
420 VTAB 22: HTAB 14 - PEEK (HF): GOSUB 320: IF KY > 15 THEN KY = TK: GOTO
    480
430 IF NOT PEEK (HF) AND KY >2 THEN 480
440 IF KY > 3 THEN 480
450 A1 = KY: PRINT N$;: GOSUB 320: IF KY > 15 THEN KY = A1: GOTO480
460 A2 = KY: GOSUB 390
470 REM CHECK FOR VALID TRACK#
480 IF KY < 0 OR KY > 34 THEN PRINT G$;: GOTO 420
490 REM SAVE OLD TRK#, POKE NEW
500 TS = TK:TK = KY: POKE TR,TK: CALLTT
510 REM GET SECTOR VALUE
520 VTAB 22: HTAB 21 - ( PEEK (HF)) * 2: GOSUB 320: IF KY >15 THEN KY = SE:
    GOTO 620
530 REM CHECK FOR HEX I/O
540 IF NOT PEEK (HF) THEN 620
550 REM SAVE KEY
560 IF KY > 1 THEN 620
570 REM GET ANOTHER KEY
580 A1 = KY: PRINT N$;: GOSUB 320: IF KY > 15 THEN KY = A1: GOTO 620
590 REM CHECK FOR VALID SECTOR#
600 A2 = KY: GOSUB 390: IF KY < 0 OR KY > 15 THEN PRINT G$;: GOTO 520
610 REM SAVE OLD SCT#, POKE NEW
620 SS = SE:SE = KY: POKE SC,SE: CALLTT
630 REM IF WRITE THEN LAST CHANCE
640 IF PEEK (CM) = WR THEN VTAB24: HTAB 2: PRINT "PRESS^RETURN^TO^->";:
    FLASH : PRINT "WRITE";: NORMAL : PRINT "<-,^ESC^TO^EXIT"G$;: NORMAL :
    POKE - 16368,0: GOSUB 210: IF KY < > 141 THEN 80
650 GOTO 710
660 REM PRINT 40 "="'S
670 FOR X = 1 TO 40: PRINT "=";: NEXT : RETURN
680 REM PRINT SCREEN PROMPTS
690 CALL TT
700 REM READ OR WRITE A SECTOR
710 CALL IO
720 REM PRINT BUFFER TO SCREEN
730 CALL MV: RETURN
740 REM COMMAND PARSER
750 POKE 216,0: CALL TT: VTAB 23: HTAB 1: CALL - 958: IF PEEK(EF) > 0 THEN
```

```
    GOSUB 240
760 REM SAVE CURRENT TRACK/SECTOR
770 TS = PEEK (TR):SS = PEEK (SC):TK = TS:SE = SS
780 CALL XC:KY = PEEK (225) - 192
790 IF KY = - 5 OR KY = - 21 THEN1380
800 IF KY < 0 OR KY > 26 THEN 750
810 ON KY GOSUB 100,1870,1830,100,1400,840,1450,100,100,100,100,100,
    100,100,1590,1480,100,420,1680,100,100,100,1720,1740,100,100:
    GOTO 750
820 PRINT G$;: GOTO 750
830 REM *** DEFINE FILTER ***
840 TEXT : HOME : VTAB 22: HTAB7: PRINT "CONFIGURATION^FOR^FILTER^#" PEEK
    (FL)
850 VTAB 2: PRINT G$"#^BLOCK^^^^^#^CHG:^^^FN#^CHR$^STATUS"
860 PRINT
870 DL = PEEK(231) + PEEK(232) * 256 - 1:CG = PEEK(233) + PEEK(234) * 256 -1
880 FI = PEEK (FL)
890 REM PRINT CURRENT VALUES
900 FOR X = 1 TO 8: PRINT X".^"F$(X)"^->^";
910 F = PEEK (CG + X)
920 F1 = INT (F / 32) + X: IF F1 > 8 THEN F1 = F1 - 8
930 F2 = F - ( INT (F / 32) * 32)
940 F3 = PEEK (DL + X)
950 F4 = PEEK (NO + FI)
960 F1(X) = F1:F2(X) = F2:F3(X) =F3 + (F(F1) * (F2 < > 0)) +(F(X) * (F2 = 0))
970 PRINT F1".^"F$(F1);: HTAB 23: PRINT F2;: HTAB 27: POKE 2091,F3: CALL
    HP: CALL AP: IF X < > 1 THEN 1000
980 HTAB 36: IF F4 = 1 THEN PRINT"ON^";
990 IF F4 = 0 THEN PRINT "OFF";
1000 PRINT : PRINT : NEXT
1010 REM EDIT CURRENT VALUES
1020 FOR X = 1 TO 8: VTAB X * 2 +2: HTAB 12
1030 REM GET BLOCK #
1040 GOSUB 50:A = KY - 176: IF N$ = CHR$ (13) THEN A = F1(X):N$ = ""
1050 IF A < 1 OR A > 8 THEN PRINTG$;: GOTO 1040
1060 PRINT N$;; HTAB 15: PRINT F$(A);: HTAB 23
1070 C = F2(X)
1080 REM CALCULATE OFFSET
1090 IF A > = X THEN F = A - X
1100 IF A < X THEN F = (8 - X) +A
1110 POKE CG + X,F * 32 + C
1120 REM GET FUNCTION #
1130 GOSUB 50:C = KY - 176: IF N$ = CHR$ (13) THEN C = F2(X):N$ = ""
1140 IF C < 0 OR C > 3 THEN PRINTG$;: GOTO 1130
1150 PRINT N$;
1160 REM CHANGE FILTER VALUE
1170 POKE CG + X,F * 32 + C
```

```
1180 KY = F3(X): IF C = 0 THEN KY = 0
1190 IF C < 1 OR C = 3 THEN 1270
1200 VTAB 20: HTAB 1: PRINT "ENTER CHARACTER:^";: GOSUB 50: IFKY = 141 THEN
     KY = F3(X)
1210 IF KY < 160 OR KY > 223 THEN PRINT G$;: GOTO 1200
1220 IF KY < 192 THEN KY = KY +(2 + A) * 32: GOTO 1240
1230 IF KY > 191 THEN KY = KY + (1 + A) * 32
1240 KY = KY - 256: HTAB 1: CALL - 868: VTAB X * 2 + 2
1250 POKE DL + X,KY
1260 HTAB 27: POKE 2091,KY: CALLHP: CALL AP
1270 NEXT
1280 REM GET FILTER STATUS
1290 PRINT : PRINT : PRINT "LEAVE^FILTER^ON^DURING^EDIT?^(Y/";: INVERSE :
     PRINT "N";: NORMAL: PRINT "):^"G$;: GOSUB 50
1300 HTAB 1: CALL - 868: VTAB 4: HTAB 36: IF N$ = "Y" THENA = 1: PRINT
     "ON^";: GOTO 1320
1310 PRINT "OFF";:A = 0
1320 POKE NO + FI,A
1330 REM RESTORE SCREEN, EXIT
1340 FOR X = 1 TO 500: NEXT
1350 GOTO 730
1360 REM ++EDIT++ MODE ENTRY POINT
1370 IF FI = 0 THEN RETURN
1380 VTAB 24: HTAB 2: INVERSE : PRINT"++EDIT++";: POKE NC,0: GOTO1410
1390 REM EDIT MODE ENTRY POINT
1400 VTAB 24: HTAB 2: INVERSE : PRINT">>EDIT<<";: POKE NC,1
1410 NORMAL : HTAB 12: PRINT "MODE";:
1420 PRINT "^^^PRESS^<ESC>^TO^EXIT";
1430 CALL ED: VTAB 23: HTAB 1: CALL - 958: GOTO 80
1440 REM TURN SOUND ON/OFF
1450 PRINT G$;: IF G$ = CHR$ (7) THEN G$ = "": RETURN
1460 G$ = CHR$ (7): RETURN
1470 REM *** PRINT HARDCOPY ***
1480 IF NOT PR THEN GOSUB 1760
1490 GOSUB 30
1500 A1 = PEEK (BF) * 256 - 1
1510 PR# PR: PRINT
1520 PRINT "TRACK:^";: POKE NM,TK: CALL HX: PRINT "^SECTOR:";: POKE NM,SE:
     CALL HX: PRINT"^VOLUME:^" PEEK (VO)
1530 FOR X = 0 TO 255 STEP 16 /LI: POKE NM,X: CALL HX: HTAB5: PRINT "-";
1540 FOR A = 1 TO 16 / LI: POKE2091, PEEK (A1 + X + A): CALLHP: NEXT
1550 FOR A = 1 TO 16 / LI: POKE2091, PEEK (A1 + X + A): CALLAP: NEXT
1560 PRINT : NEXT
1570 PR# 0: GOTO 80
1580 REM *** JUMP CURSOR ***
1590 VTAB 22: HTAB 32 - PEEK (HF): GOSUB 320: IF KY > 15 THEN CALL TT:
     RETURN
1600 A1 = KY: PRINT N$;: GOSUB 320: IF KY > 15 THEN KY = A1: GOTO1660
```

```
1610 A2 = KY: PRINT N$;: GOSUB 390: IF NOT PEEK (HF) THEN 1660
1620 IF KY > 25 THEN 1660
1630 A1 = KY: GOSUB 320: IF KY >15 THEN KY = A1: GOTO 1660
1640 A2 = KY: PRINT N$;: GOSUB 390: IF KY < 0 OR KY > 255 THEN CALL TT: GOTO
     1590
1650 REM CALCULATE NEW CURSOR POSN
1660 POKE CS,KY: CALL MV: CALL TT: RETURN
1670 REM CHANGE SLOT NO.
1680 VTAB 22: HTAB 4: GOSUB 320: IF KY > 15 THEN CALL TT: RETURN
1690 IF KY < 1 OR KY > 7 THEN 1680
1700 POKE SL,KY * 16: CALL TT: RETURN
1710 REM WRITE A TRACK/SECTOR
1720 POKE CM,WR: GOSUB 420: POKECM,RD: CALL TT: RETURN
1730 REM CLEAR SCREEN, RECONNECT DOS AND EXIT TO BASIC
1740 TEXT : HOME : POKE 103,1: POKE104,8: CALL 1002: END
1750 REM FIND PRINTER SLOT
1760 GOSUB 30: VTAB 12: PRINT "WHICH^SLOT^IS^YOUR^PRINTER^USING?^1-7^";:
     GOSUB 320: IFKY > 15 THEN RETURN
1770 IF KY > 7 THEN GOSUB 120: GOTO1760
1780 IF NOT KY THEN RETURN
1790 PR = KY:LI = 2
1800 PRINT : PRINT : PRINT TAB(6)"PRINT^USING^80^COLUMNS^(Y/";: INVERSE :
     PRINT "N";: NORMAL: PRINT "):";: GOSUB 50: IFN$ = "Y" THEN LI = 1
1810 RETURN
1820 REM CALL FOR CATALOG
1830 CALL 1002: ONERR GOTO 1850
1840 GOSUB 30: PRINT : PRINT CHR$(4)"CATALOG,D" PEEK (DR)",S" PEEK (SL) /
     16: PRINT : CALLFR: POKE 35,24: VTAB 24: HTAB7: PRINT
     "PRESS^ANY^KEY^TO^CONTINUE^";: GOSUB 210: GOTO730
1850 POKE 216,0: GOTO 240
1860 REM DISASSEMBLE THE BUFFER
1870 GOSUB 30: VTAB 21: PRINT : PRINT:KY = PEEK (CS)
1880 REM START AT CURSOR
1890 POKE 58,KY: POKE 59, PEEK (BF)
1900 A1 = 0:A2 = 21
1910 REM START AT LAST BYTE
1920 FOR X = 1 TO A2: IF PEEK (59) > PEEK (BF) THEN :A1 =1: IF PEEK (1152) <
     > 160 THEN PRINT : GOTO 2090
1930 IF A1 THEN PRINT : NEXT : GOTO2090
1940 CALL BI
1950 NEXT
1960 REM <ESC> KEY? = EXIT
1970 GOSUB 210: IF KY = 155 THEN2130
1980 REM <RTN> KEY? = 20 LINES
1990 IF KY = 141 THEN 1900
2000 REM <SPACE> KEY? = 1 LINE
2010 IF KY = 160 THEN A2 = 1: GOTO1920
2020 IF KY = 213 THEN GOSUB 140: GOSUB 1550: VTAB 1: GOTO 1890
```

```
2030 IF KY < > 208 THEN 1970
2040 REM PRINT SCREEN
2050 GOSUB 140:L = KY
2060 IF NOT PR THEN GOSUB 1760
2070 HOME :KY = L: PR# PR: GOTO1890
2080 REM PRINT EXIT MESSAGE
2090 PRINT "END^OF^BUFFER^PRESS^RETURN^TO^CONTINUE";: GOSUB210
2100 REM LAST CHANCE TO PRINT
2110 IF KY = 208 THEN 2050
2120 REM EXIT BINARY ROUTINE
2130 PRINT : POKE 35,24: PR# 0: GOTO730
2140 REM DEFINE VARIABLES
2150 RD = 1:WR = 2:LI = 2
2160 SL = 2071:DR = 2072:VO = 2084:TR = 2074:SC = 2075:CM = 2082
2170 NM = 2091:FL = 2101:EF = 2094:HF = 2095:CS = 2100:BF = 2103
2180 NC = 2099
2190 FI = PEEK (FL)
2200 NO = PEEK (2106) + PEEK (2107) * 256
2210 IO = 2111:MV = 2114:HX = 2117:ED = 2120:BI = 2123:FR = 2126:TT =
     2129:XC = 2135
2220 HP = 2141:AP = 2144
2230 F$(1) = "INV1":F$(2) = "INV2":F$(3) = "FLS1":F$(4) = "FLS2":F$(5) =
     "CTRL":F$(6) = "NOR1":F$(7) = "NOR2":F$(8) ="L/C^"
2240 F(1) = 192:F(2) = 128:F(3) =128:F(4) = 64:F(5) = 64:F(6) = 0:F(7) =
     0:F(8) = - 64
2250 G$ = CHR$ (7)
2260 VTAB 8: PRINT "D^I^S^K^E^D^I^T^^^^V^E^R^S^I^O^N^^^4^.^0": PRINT
     "^COPYRIGHT^1981^(C)^HARDCORE^COMPUTIST": PRINT
2270 HTAB 5: FOR X = 1 TO 32: PRINT"-";: NEXT : PRINT : HTAB 6: PRINT
     "A^DISK^EDITING^UTILITY^PROGRAM"
2280 HTAB 5: FOR X = 1 TO 32: PRINT"-";: NEXT : PRINT : PRINT
2290 VTAB 22: PRINT "INSERT^DISK^--^PRESS^ANY^KEY^TO^CONTINUE";: GOSUB
     210: VTAB 22: CALL - 958: GOTO 730
```

Diskedit source code

```
                0010
                0015 * DISKEDIT II - VERSION 4.1
                0020 * COPYRIGHT 1981 SOFTKEY
                0025 * LAST UPDATED MAR 24 84
                0030
                0035          .OR $800
                0040          .TF EDO
                0045
0022-           0050 WNDTOP   .EQ $22
0023-           0055 WNDBTM   .EQ $23
0024-           0060 CH       .EQ $24
0025-           0065 CV       .EQ $25
0026-           0070 BASE2    .EQ $26,27
```

```
0028-           0075 BASE1     .EQ $28,29
003A-           0080 PCL       .EQ $3A,3B
0048-           0085 IOBPL     .EQ $48
0067-           0090 PRGSTR    .EQ $67
00E0-           0095 LOC       .EQ $E0
00E1-           0100 NUM       .EQ $E1
00E4-           0105 BUFFER.POINTER .EQ $E4
00E7-           0110 DCHR      .EQ $E7,E8
00E9-           0115 CFLT      .EQ $E9,EA
03D9-           0120 RWTS      .EQ $3D9
03E3-           0125 GETIOB    .EQ $3E3
C000-           0130 KEY       .EQ $C000
C010-           0135 STROBE    .EQ $C010
B3F2-           0140 VTOC      .EQ $B3F2
ED24-           0145 LINPRT    .EQ $ED24
F88C-           0150 INSDS     .EQ $F88C
F8D3-           0155 INSTDS    .EQ $F8D3
F94A-           0160 PRBLANK   .EQ $F94A
F953-           0165 PCADJ     .EQ $F953
FC58-           0170 HOME      .EQ $FC58
FC62-           0175 CR.LF     .EQ $FC62
FDDA-           0180 PRHEX     .EQ $FDDA
FDED-           0185 COUT      .EQ $FDED
                0190 * ----------------------------CHARACTER CODES
0080-           0195 CTRL.AT   .EQ $80
0081-           0200 CTRL.A    .EQ $81
0082-           0205 CTRL.B    .EQ $82
0084-           0210 CTRL.D    .EQ $84
0086-           0215 CTRL.F    .EQ $86
0088-           0220 CTRL.H    .EQ $88
0089-           0225 CTRL.I    .EQ $89
008C-           0230 CTRL.L    .EQ $8C
008D-           0235 RETURN    .EQ $8D
008E-           0240 CTRL.N    .EQ $8E
0091-           0245 CTRL.Q    .EQ $91
0095-           0250 CTRL.U    .EQ $95
009A-           0255 CTRL.Z    .EQ $9A
009B-           0260 ESCAPE    .EQ $9B
00A0-           0265 SPACE     .EQ $A0
00AA-           0270 STAR      .EQ $AA
00AE-           0275 PERIOD    .EQ $AE
00B5-           0280 FIVE      .EQ $B5
00C9-           0285 LTR.I     .EQ $C9
00CA-           0290 LTR.J     .EQ $CA
00CB-           0295 LTR.K     .EQ $CB
00CD-           0300 LTR.M     .EQ $CD
                0305
```

```
                    0310 * ----------------------1ST LINE OF BASIC PROGRAM
                    0315
0800- 00 11 08
0803- 00 00 8C
0806- 32 30         0320 START     .HS 00110800008C3230
0808- 36 37 3A
080B- AB 31 30
080E- 3A B2         0325           .HS 36373AAB31303AB2
0810- 00 00 00      0330           .HS 000000
0813- 4C 73 08      0335           JMP INITDOS
                    0340
                    0345 * ---------------------------INPUT/OUTPUT BLOCK
                    0350
0816- 01            0355 IOBIND    .HS 01
0817- 60            0360 SLOT      .HS 60          SLOT * 16
0818- 01            0365 DRIVE     .HS 01          DRIVE #
0819- 00            0370 EXPVOL    .HS 00          REQ. VOLUME
081A- 00            0375 TRACK     .HS 00          TRACK #
081B- 00            0380 SECTOR    .HS 00          SECTOR #
081C- 27 08         0385           .DA DCT
081E- 00 09         0390           .DA BUFFER
0820- 00 00         0395           .HS 0000
0822- 01            0400 CMND      .HS 01          COMMAND
0823- 00            0405 ERCODE    .HS 00          ERROR CODE
0824- 00            0410 VOLUME    .HS 00          VOLUME #
0825- 60            0415 OLDSLOT   .HS 60          PREV. SLOT
0826- 01            0420 OLDRIVE   .HS 01          PREV. DRIVE
                    0425
0827- 00            0430 DCT       .HS 00          TYPE CODE
0828- 01            0435 PHASES    .HS 01          PHASES/TRK
0829- EF D8         0440           .HS EFD8        TIME COUNT
                    0445
                    0450 * -----------------------------BASIC variables
                    0455
082B- 00            0460 BYTE      .HS 00          NM
082C- 00            0465 OLDTRK    .HS 00          OT
082D- 00            0470 OLDSCT    .HS 00          OS
082E- 00            0475 ERRFLG    .HS 00          EF
082F- 00            0480 HEX.OR.DEC.FLG .HS 00 HF
0830- 01            0485 ON.OFF    .HS 01          ST
0831- 01            0490 CFLG      .HS 01          PF
0832- 00            0495           .HS 00
0833- 00            0500 USE.CTRL.CHARS .HS 00 TH
0834- 00            0505 CRSVAL    .HS 00          CS
0835- 01            0510 FLTNUM    .HS 01          FL
0836- 00            0515           .HS 00
0837- 09            0520           .DA /BUFFER     BF
0838- 00 00         0525           .HS 0000
```

```
083A- 8B 0C    0530          .DA FSTAT    NO
083C- 00 00 00 0535          .HS 000000
               0540
               0545 * ----------------------------BASIC Call table
               0550
083F- 4C 90 08 0555          JMP CALLIO   IO
0842- 4C 29 0A 0560          JMP PRINT.SCREEN.DATA
0845- 4C 0E 12 0565          JMP HXBYTE
0848- 4C 7E 0F 0570          JMP EDIT     ED
084B- 4C 00 0A 0575          JMP BINARY   BI
084E- 4C 6B 0B 0580          JMP CALC.FREE.SECTORS FR
0851- 4C C9 0C 0585          JMP PROMPT   TT
0854- 4C BD 0C 0590          JMP PROMPT0  T1
0857- 4C 5D 0E 0595          JMP PARSE    XC
085A- 4C AE 0B 0600          JMP FILTER0  HC
085D- 4C 03 12 0605          JMP HEXPRINT HP
0860- 4C DA 11 0610          JMP ASCPRINT AP
0863- 4C 0A 0E 0615          JMP RIGHT    UNUSED
0866- 60 60 60 0620          .HS 606060   UNUSED
               0625
               0630 * ---------------------------INTERNAL VARIABLES
               0635
0869- 00       0640 OFFSET   .HS 00
086A- FF       0645 FIRST    .HS FF
086B- 01       0650 EDFLG    .HS 01
086C- 00       0655 HCOUNT   .HS 00
086D- 00       0660 SPACES   .HS 00
086E- 00       0665 EDIT.MODE.FLAG .HS 00
086F- 01       0670 KEYFLG   .HS 01
0870- 10       0675 MAXSCT   .HS 10
0871- 23       0680 MAXTRK   .HS 23
0872- 00       0685 SPECIAL.FUNCTION .HS 00
               0690
               0695 * ----------------------------Get DOS pointers
               0700
0873- 20 E3 03 0705 INITDOS  JSR GETIOB
0876- 84 48    0710          STY IOBPL
0878- 85 49    0715          STA IOBPL+1
087A- A0 01    0720          LDY #1
087C- B1 48    0725          LDA (IOBPL),Y
087E- 8D 17 08 0730          STA SLOT
0881- C8       0735          INY
0882- B1 48    0740          LDA (IOBPL),Y
0884- 8D 18 08 0745          STA DRIVE
               0750 * -------------------------Reset program pointer
0887- A9 1F    0755          LDA #STOP
0889- 85 67    0760          STA PRGSTR
088B- A9 12    0765          LDA /STOP
```

```
088D- 85 68    0770          STA PRGSTR+1
088F- 60       0775          RTS
               0780
               0785 * ----------------Call Read/Write Track Sector
               0790
0890- A9 08    0795 CALLIO   LDA /IOBIND
0892- A0 16    0800          LDY #IOBIND
0894- 20 D9 03 0805          JSR RWTS
0897- 90 06    0810          BCC .1
0899- AD 23 08 0815          LDA ERCODE    GET ERROR #
089C- 8D 2E 08 0820          STA ERRFLG
089F- 60       0825 .1       RTS
               0830
               0835 * ------------------------------Put buffer here
               0840
08A0-          0845          .BS $900-*
0900-          0850 BUFFER   .BS $100      256 bytes
               0855
               0860 * -------------------Disassemble an instruction
               0865
0A00- A9 8D    0870 BINARY   LDA #RETURN
0A02- 20 ED FD 0875          JSR COUT      PRINT <CR>
0A05- A5 3A    0880          LDA PCL
0A07- 8D 2B 08 0885          STA BYTE
0A0A- 20 0E 12 0890          JSR HXBYTE
0A0D- A9 04    0895 STEP     LDA #4
0A0F- 85 24    0900          STA CH
0A11- A9 AD    0905          LDA #$AD
0A13- 20 ED FD 0910          JSR COUT      Print dash
0A16- A2 01    0915          LDX #1        and a
0A18- 20 4A F9 0920          JSR PRBLANK   space.
0A1B- 20 8C F8 0925          JSR INSDS     Disassem
0A1E- 20 D3 F8 0930          JSR INSTDS    current
0A21- 20 53 F9 0935          JSR PCADJ     instr.
0A24- 85 3A    0940          STA PCL       & update
0A26- 84 3B    0945          STY PCL+1     prg cntr.
0A28- 60       0950          RTS
               0955
               0960 * ------------------------------Select a filter
               0965
               0970 PRINT.SCREEN.DATA
               0975
0A29- AD 35 08 0980          LDA FLTNUM
0A2C- 0A       0985          ASL
0A2D- 0A       0990          ASL
0A2E- AA       0995          TAX
0A2F- A0 00    1000          LDY #0
0A31- BD 95 0C 1005 .1       LDA FLT.LOC,X
```

```
0A34- 99 E7 00 1010          STA DCHR,Y
0A37- E8      1015           INX
0A38- C8      1020           INY
0A39- C0 04   1025           CPY #4
0A3B- 90 F4   1030           BCC .1
              1035
              1040 *----------------Print buffer data to screen
              1045
0A3D- A9 00   1050           LDA #0
0A3F- 85 E4   1055           STA BUFFER.POINTER
0A41- 85 25   1060           STA CV
0A43- 20 CF 0A 1065 .2       JSR PRINT.OLD.LINE
0A46- E6 25   1070           INC CV
0A48- A5 25   1075           LDA CV
0A4A- C9 14   1080           CMP #20       Last line?
0A4C- D0 F5   1085           BNE .2        No!
0A4E- A5 25   1090           LDA CV
0A50- 20 8F 0A 1095          JSR FIND.BASE.ADDR
0A53- A0 27   1100           LDY #39
0A55- A9 A0   1105           LDA #SPACE
0A57- 91 28   1110 .3        STA (BASE1),Y
0A59- 88      1115           DEY
0A5A- 10 FB   1120           BPL .3
0A5C- 4C C9 0C 1125          JMP PROMPT
              1130
              1135 *---------------Memory locations for text scrn
              1140
              1145 TEXT.SCREEN.BYTE
              1150
0A5F- 00 04   1155           .DA $400      Line 1
0A61- 80 04   1160           .DA $480
0A63- 00 05   1165           .DA $500
0A65- 80 05   1170           .DA $580
0A67- 00 06   1175           .DA $600
0A69- 80 06   1180           .DA $680
0A6B- 00 07   1185           .DA $700
0A6D- 80 07   1190           .DA $780
0A6F- 28 04   1195           .DA $428
0A71- A8 04   1200           .DA $4A8
0A73- 28 05   1205           .DA $528
0A75- A8 05   1210           .DA $5A8
0A77- 28 06   1215           .DA $628
0A79- A8 06   1220           .DA $6A8
0A7B- 28 07   1225           .DA $728
0A7D- A8 07   1230           .DA $7A8
0A7F- 50 04   1235           .DA $450
0A81- D0 04   1240           .DA $4D0
0A83- 50 05   1245           .DA $550
```

```
0A85- D0 05    1250          .DA $5D0
0A87- 50 06    1255          .DA $650
0A89- D0 06    1260          .DA $6D0
0A8B- 50 07    1265          .DA $750
0A8D- D0 07    1270          .DA $7D0     Line 24
               1275
               1280
               1285 * ----------------------Enter with line# in ACC.
               1290
               1295 FIND.BASE.ADDR
               1300
0A8F- 0A       1305          ASL
0A90- AA       1310          TAX
0A91- BD 5F 0A 1315          LDA TEXT.SCREEN.BYTE,X
0A94- 85 28    1320          STA BASE1
0A96- 18       1325          CLC
0A97- 69 1B    1330          ADC #27
0A99- 85 26    1335          STA BASE2
0A9B- BD 60 0A 1340          LDA TEXT.SCREEN.BYTE+1,X
0A9E- 85 29    1345          STA BASE1+1
0AA0- 85 27    1350          STA BASE2+1
0AA2- 60       1355          RTS
               1360
               1365 * ----------------------Convert CRSVAL to line#
               1370
               1375 FIND.CURRENT.LINE
               1380
0AA3- A2 14    1385          LDX #20
0AA5- CA       1390 .1       DEX
0AA6- BD B8 0A 1395          LDA FIRST.CHAR.POSN,X
0AA9- CD 34 08 1400          CMP CRSVAL
0AAC- 90 05    1405          BCC .2
0AAE- F0 03    1410          BEQ .2
0AB0- 4C A5 0A 1415          JMP .1
0AB3- 86 25    1420 .2       STX CV
0AB5- 85 E4    1425          STA BUFFER.POINTER
0AB7- 60       1430          RTS
               1435
               1440 FIRST.CHAR.POSN
               1445
0AB8- 00 0D 1A
0ABB- 27 34 41
0ABE- 4E       1450          .HS 000D1A2734414E
0ABF- 5B 68 75
0AC2- 82 8F 9C
0AC5- A9       1455          .HS 5B6875828F9CA9
0AC6- B6 C3 D0
0AC9- DD EA F7 1460          .HS B6C3D0DDEAF7
```

```
                1465
                1470 PRINT.NEW.LINE
                1475
0ACC- 20 A3 0A  1480          JSR FIND.CURRENT.LINE
                1485
                1490 PRINT.OLD.LINE
                1495
0ACF- A5 25     1500          LDA CV
0AD1- 20 8F 0A  1505          JSR FIND.BASE.ADDR
0AD4- A9 0D     1510          LDA #13
0AD6- 8D 6C 08  1515          STA HCOUNT
0AD9- A6 E4     1520          LDX BUFFER.POINTER
0ADB- BD 00 09  1525 .2       LDA BUFFER,X
0ADE- 48        1530          PHA
0ADF- EC 34 08  1535          CPX CRSVAL
0AE2- D0 05     1540          BNE .3
0AE4- AE 6F 08  1545          LDX KEYFLG
0AE7- F0 03     1550          BZR .4
0AE9- 20 B1 0B  1555 .3       JSR FILTER
0AEC- A0 00     1560 .4       LDY #0
0AEE- 91 26     1565          STA (BASE2),Y
0AF0- E6 26     1570          INC BASE2
0AF2- 68        1575          PLA
0AF3- AE 6F 08  1580          LDX KEYFLG
0AF6- F0 44     1585          BZR .9
0AF8- 48        1590          PHA
0AF9- 4A        1595          LSR
0AFA- 4A        1600          LSR
0AFB- 4A        1605          LSR
0AFC- 4A        1610          LSR
0AFD- A6 E4     1615          LDX BUFFER.POINTER
0AFF- EC 34 08  1620          CPX CRSVAL
0B02- D0 0B     1625          BNE .5
0B04- 09 30     1630          ORA #$30
0B06- C9 3A     1635          CMP #$3A
0B08- 90 0D     1640          BCC .6
0B0A- E9 39     1645          SBC #$39
0B0C- 4C 17 0B  1650          JMP .6
0B0F- 09 B0     1655 .5       ORA #$B0
0B11- C9 BA     1660          CMP #$BA
0B13- 90 02     1665          BCC .6
0B15- 69 06     1670          ADC #$06
0B17- 91 28     1675 .6       STA (BASE1),Y
0B19- E6 28     1680          INC BASE1
0B1B- 68        1685          PLA
0B1C- 29 0F     1690          AND #$0F
0B1E- A6 E4     1695          LDX BUFFER.POINTER
0B20- EC 34 08  1700          CPX CRSVAL
```

```
0B23- D0 0B    1705          BNE .7
0B25- 09 30    1710          ORA #$30
0B27- C9 3A    1715          CMP #$3A
0B29- 90 0D    1720          BCC .8
0B2B- E9 39    1725          SBC #$39
0B2D- 4C 38 0B 1730          JMP .8
0B30- 09 B0    1735 .7       ORA #$B0
0B32- C9 BA    1740          CMP #$BA
0B34- 90 02    1745          BCC .8
0B36- 69 06    1750          ADC #$06
0B38- 91 28    1755 .8       STA (BASE1),Y
0B3A- E6 28    1760          INC BASE1
0B3C- E6 E4    1765 .9       INC BUFFER.POINTER
0B3E- A6 E4    1770          LDX BUFFER.POINTER
0B40- F0 08    1775          BZR .10
0B42- CE 6C 08 1780          DEC HCOUNT
0B45- AD 6C 08 1785          LDA HCOUNT
0B48- D0 91    1790          BNE .2
0B4A- AE 6F 08 1795 .10      LDX KEYFLG
0B4D- F0 1B    1800          BZR .12
0B4F- A9 A0    1805          LDA #$A0
0B51- 91 28    1810          STA (BASE1),Y
0B53- A6 25    1815          LDX CV
0B55- E0 13    1820          CPX #19
0B57- D0 11    1825          BNE .12
0B59- A9 A0    1830          LDA #SPACE
0B5B- 91 26    1835 .11      STA (BASE2),Y
0B5D- 91 28    1840          STA (BASE1),Y
0B5F- E6 28    1845          INC BASE1
0B61- 91 28    1850          STA (BASE1),Y
0B63- C8       1855          INY
0B64- C0 04    1860          CPY #4
0B66- D0 F3    1865          BNE .11
0B68- 91 28    1870          STA (BASE1),Y
0B6A- 60       1875 .12      RTS
               1880
               1885 * ----------------------------------------
               1890
               1895 CALC.FREE.SECTORS
               1900
0B6B- A9 00    1905          LDA #$00
0B6D- 85 E1    1910          STA NUM
0B6F- 85 E2    1915          STA NUM+1
0B71- A0 C8    1920          LDY #$C8
0B73- B9 F2 B3 1925 NXTBYTE  LDA VTOC,Y
0B76- F0 0B    1930 NXTBIT   BEQ .2
0B78- 0A       1935 .1       ASL
0B79- 90 FB    1940          BCC NXTBIT
```

```
0B7B- E6 E1    1945          INC NUM
0B7D- D0 F9    1950          BNE .1
0B7F- E6 E2    1955          INC NUM+1
0B81- D0 F5    1960          BNE .1
0B83- 88       1965 .2       DEY
0B84- D0 ED    1970          BNE NXTBYTE
0B86- A2 0F    1975          LDX #15
0B88- BD 9D 0B 1980 .3       LDA FSTEXT-1,X
0B8B- 20 ED FD 1985          JSR COUT
0B8E- CA       1990          DEX
0B8F- D0 F7    1995          BNE .3
0B91- A6 E1    2000          LDX NUM
0B93- A5 E2    2005          LDA NUM+1
0B95- 20 24 ED 2010          JSR LINPRT
0B98- A9 8D    2015          LDA #RETURN
0B9A- 20 ED FD 2020          JSR COUT
0B9D- 60       2025          RTS
0B9E- A0 BD A0
0BA1- C5 C5 D2
0BA4- C6 A0 D3
0BA7- D2 CF D4
0BAA- C3 C5 D3
0BAD- A0       2030 FSTEXT   .AS -" = EERF SROTCES "
               2035
               2040 * ----------------------Screen character filter
               2045
0BAE- AD 2B 08 2050 FILTER0  LDA BYTE
0BB1- 85 E0    2055 FILTER   STA LOC
0BB3- 4A       2060          LSR
0BB4- 4A       2065          LSR
0BB5- 4A       2070          LSR
0BB6- 4A       2075          LSR
0BB7- 4A       2080          LSR
0BB8- A8       2085          TAY
0BB9- B1 E9    2090          LDA (CFLT),Y
0BBB- AA       2095          TAX
0BBC- 29 F0    2100          AND #$F0
0BBE- 18       2105          CLC
0BBF- 65 E0    2110          ADC LOC
0BC1- 85 E0    2115          STA LOC
0BC3- 8A       2120          TXA
0BC4- 29 0F    2125          AND #$0F
0BC6- D0 03    2130          BNE .2
0BC8- A5 E0    2135 .1       LDA LOC
0BCA- 60       2140          RTS
               2145
               2150 * ----------------------------Select function
               2155
```

```
0BCB- C9 01    2160 .2      CMP #1       Function 1?
0BCD- D0 09    2165         BNE .4
0BCF- B1 E7    2170         LDA (DCHR),Y
0BD1- C5 E0    2175         CMP LOC
0BD3- D0 F3    2180         BNE .1
0BD5- A9 A0    2185 .3      LDA #SPACE
0BD7- 60       2190         RTS
0BD8- C9 02    2195 .4      CMP #2       Function 2?
0BDA- D0 08    2200         BNE .5
0BDC- B1 E7    2205         LDA (DCHR),Y
0BDE- C5 E0    2210         CMP LOC
0BE0- F0 E6    2215         BEQ .1
0BE2- D0 F1    2220         BNE .3
0BE4- C9 03    2225 .5      CMP #3       Function 3?
0BE6- F0 ED    2230         BEQ .3
0BE8- 4C C8 0B 2235         JMP .1
               2240
               2245
               2250 * ----------------------Filter parameter data
               2255
0BEB-          2260 CHG0    .BS 8
0BF3-          2265 CHG1    .BS 8
0BFB- C0 80 80
0BFE- 40 80 00
0C01- 00 E0    2270 CHG2    .HS C0808040800000E0
0C03- C1 81 81
0C06- 41 81 01
0C09- 01 E1    2275 CHG3    .HS C1818141810101E1
0C0B- C0 80 80
0C0E- 40 01 00
0C11- 00 E0    2280 CHG4    .HS C0808040010000E0
0C13- 02 02 02
0C16- 02 C0 00
0C19- 40 E0    2285 CHG5    .HS 02020202C00040E0
0C1B- 00 00 00
0C1E- 00 00 00
0C21- 00 00    2290 CHG6    .HS 0000000000000000
0C23- C0 80 80
0C26- 40 80 00
0C29- 00 E0    2295 CHG7    .HS C0808040800000E0
0C2B-          2300 CHG8    .BS 8
0C33-          2305 CHG9    .BS 8
               2310
               2315 * ----------------------------------------
               2320
0C3B-          2325 DEL0    .BS 8
0C43-          2330 DEL1    .BS 8
0C4B-          2335 DEL2    .BS 8
```

```
0C53- C0 A0 C0
0C56- A0 00 A0
0C59- C0 C0     2340 DEL3     .HS C0A0C0A000A0C0C0
0C5B-           2345 DEL4     .BS 8
0C63-           2350 DEL5     .BS 8
0C6B-           2355 DEL6     .BS 8
0C73-           2360 DEL7     .BS 8
0C7B-           2365 DEL8     .BS 8
0C83-           2370 DEL9     .BS 8
                2375
                2380 * ----------------------------FILTER STATUS 1=ON
                2385
0C8B- 00        2390 FSTAT    .HS 00        FILTER #0
0C8C- 00 00 00
0C8F- 00 01 00
0C92- 00 00 00  2395          .HS 000000000100000000
                2400
                2405 * -------------------------FILTER PARM LOCATIONS
                2410
0C95- 3B 0C     2415 FLT.LOC  .DA DEL0
0C97- EB 0B     2420          .DA CHG0
0C99- 43 0C     2425          .DA DEL1
0C9B- F3 0B     2430          .DA CHG1
0C9D- 4B 0C     2435          .DA DEL2
0C9F- FB 0B     2440          .DA CHG2
0CA1- 53 0C     2445          .DA DEL3
0CA3- 03 0C     2450          .DA CHG3
0CA5- 5B 0C     2455          .DA DEL4
0CA7- 0B 0C     2460          .DA CHG4
0CA9- 63 0C     2465          .DA DEL5
0CAB- 13 0C     2470          .DA CHG5
0CAD- 6B 0C     2475          .DA DEL6
0CAF- 1B 0C     2480          .DA CHG6
0CB1- 73 0C     2485          .DA DEL7
0CB3- 23 0C     2490          .DA CHG7
0CB5- 7B 0C     2495          .DA DEL8
0CB7- 2B 0C     2500          .DA CHG8
0CB9- 83 0C     2505          .DA DEL9
0CBB- 33 0C     2510          .DA CHG9
                2515
                2520 * -------------------------Print screen prompts
                2525
0CBD- AD 2C 08  2530 PROMPT0  LDA OLDTRK
0CC0- 8D 1A 08  2535          STA TRACK
0CC3- AD 2D 08  2540          LDA OLDSCT
0CC6- 8D 1B 08  2545          STA SECTOR
0CC9- A9 15     2550 PROMPT   LDA #21
0CCB- 20 8F 0A  2555          JSR FIND.BASE.ADDR
```

```
0CCE- A0 00    2560          LDY #0
0CD0- B9 72 0D 2565 .1       LDA PROMPT1,Y
0CD3- 91 28    2570          STA (BASE1),Y
0CD5- C8       2575          INY
0CD6- C0 03    2580          CPY #3
0CD8- 90 F6    2585          BCC .1
0CDA- AD 17 08 2590          LDA SLOT
0CDD- 4A       2595          LSR
0CDE- 4A       2600          LSR
0CDF- 4A       2605          LSR
0CE0- 4A       2610          LSR
0CE1- 09 B0    2615          ORA #$B0
0CE3- 91 28    2620          STA (BASE1),Y
0CE5- C8       2625          INY
0CE6- B9 72 0D 2630 .2       LDA PROMPT1,Y
0CE9- 91 28    2635          STA (BASE1),Y
0CEB- C8       2640          INY
0CEC- C0 08    2645          CPY #8
0CEE- 90 F6    2650          BCC .2
0CF0- AD 18 08 2655          LDA DRIVE
0CF3- 09 B0    2660          ORA #$B0
0CF5- 91 28    2665          STA (BASE1),Y
0CF7- C8       2670          INY
0CF8- B9 72 0D 2675 .3       LDA PROMPT1,Y
0CFB- 91 28    2680          STA (BASE1),Y
0CFD- C8       2685          INY
0CFE- C0 0C    2690          CPY #12
0D00- 90 F6    2695          BCC .3
0D02- AD 1A 08 2700          LDA TRACK
0D05- 20 D1 10 2705          JSR PRINT.HEX.OR.DECIMAL
0D08- B9 72 0D 2710 .4       LDA PROMPT1,Y
0D0B- 91 28    2715          STA (BASE1),Y
0D0D- C8       2720          INY
0D0E- C0 12    2725          CPY #18
0D10- 90 F6    2730          BCC .4
0D12- AD 1B 08 2735          LDA SECTOR
0D15- 20 D1 10 2740          JSR PRINT.HEX.OR.DECIMAL
0D18- B9 72 0D 2745 .5       LDA PROMPT1,Y
0D1B- 91 28    2750          STA (BASE1),Y
0D1D- C8       2755          INY
0D1E- C0 18    2760          CPY #24
0D20- 90 F6    2765          BCC .5
0D22- AD 24 08 2770          LDA VOLUME
0D25- 20 D1 10 2775          JSR PRINT.HEX.OR.DECIMAL
0D28- B9 72 0D 2780 .6       LDA PROMPT1,Y
0D2B- 91 28    2785          STA (BASE1),Y
0D2D- C8       2790          INY
0D2E- C0 1E    2795          CPY #30
```

```
0D30- 90 F6    2800          BCC .6
0D32- AD 34 08 2805          LDA CRSVAL
0D35- 20 D1 10 2810          JSR PRINT.HEX.OR.DECIMAL
0D38- B9 72 0D 2815 .7       LDA PROMPT1,Y
0D3B- 91 28    2820          STA (BASE1),Y
0D3D- C8       2825          INY
0D3E- C0 23    2830          CPY #35
0D40- 90 F6    2835          BCC .7
0D42- AD 35 08 2840          LDA FLTNUM
0D45- 09 B0    2845          ORA #$B0
0D47- 91 28    2850          STA (BASE1),Y
0D49- C8       2855          INY
0D4A- B9 72 0D 2860 .8       LDA PROMPT1,Y
0D4D- 91 28    2865          STA (BASE1),Y
0D4F- C8       2870          INY
0D50- C0 25    2875          CPY #37
0D52- 90 F6    2880          BCC .8
0D54- AE 6E 08 2885          LDX EDIT.MODE.FLAG
0D57- BD 63 0D 2890 .9       LDA EDIT.MODE.TEXT,X
0D5A- 91 28    2895          STA (BASE1),Y
0D5C- C8       2900          INY
0D5D- E8       2905          INX
0D5E- C0 28    2910          CPY #40
0D60- 90 F5    2915          BCC .9
0D62- 60       2920          RTS
               2925 * ---------------------------------------
               2930 EDIT.MODE.TEXT
               2935
0D63- 08 05 18
0D66- 01 13 03
0D69- 09 0E    2940          .HS 080518011303090E
0D6B- 16 06 0C
0D6E- 13 0C 2F
0D71- 03       2945          .HS 16060C130C2F03
               2950
               2955 PROMPT1
               2960
0D72- 13 0C BA
0D75- A0 A0    2965          .HS 130CBAA0A0 ....SL
0D77- 04 12 BA
0D7A- A0 A0    2970          .HS 0412BAA0A0 ....DR
0D7C- 14 BA A0
0D7F- A0 A0 A0 2975          .HS 14BAA0A0A0A0 ..T
0D82- 13 BA A0
0D85- A0 A0 A0 2980          .HS 13BAA0A0A0A0 ..S
0D88- 16 BA A0
0D8B- A0 A0 A0 2985          .HS 16BAA0A0A0A0 ..V
0D8E- 02 BA A0
```

```
0D91- A0 A0 A0 2990          .HS 02BAA0A0A0A0 ..B
0D94- 06 A0 A0
0D97- A0 A0 A0 2995          .HS 06A0A0A0A0A0 ..F
               3000
               3005 * ---------------------------------------
               3010
               3015 SET.HEX.OR.DEC
               3020
0D9A- A2 01    3025          LDX #1
0D9C- EC 2F 08 3030          CPX HEX.OR.DEC.FLG
0D9F- D0 01    3035          BNE .1
0DA1- CA       3040          DEX
0DA2- 8E 2F 08 3045 .1       STX HEX.OR.DEC.FLG
0DA5- 4C C9 0C 3050          JMP PROMPT
               3055 * ---------------------------------------
0DA8- A2 01    3060 SWT.DRV  LDX #1
0DAA- EC 18 08 3065          CPX DRIVE
0DAD- D0 01    3070          BNE .1
0DAF- E8       3075          INX
0DB0- 8E 18 08 3080 .1       STX DRIVE
0DB3- 4C C9 0C 3085          JMP PROMPT
               3090 * ---------------------------------------
0DB6- A5 E1    3095 FSET     LDA LOC+1
0DB8- 38       3100          SEC
0DB9- E9 B0    3105          SBC #$B0
0DBB- 8D 35 08 3110          STA FLTNUM
0DBE- 4C 29 0A 3115          JMP PRINT.SCREEN.DATA
               3120 * ---------------------------------------
0DC1- CE 1B 08 3125 DEC.SCT  DEC SECTOR
0DC4- 10 13    3130          BPL IOJMP
0DC6- AE 70 08 3135          LDX MAXSCT
0DC9- CA       3140          DEX
0DCA- 8E 1B 08 3145          STX SECTOR
               3150 * ---------------------------------------
0DCD- CE 1A 08 3155 DEC.TRK  DEC TRACK
0DD0- 10 07    3160          BPL IOJMP
0DD2- AE 71 08 3165          LDX MAXTRK
0DD5- CA       3170          DEX
0DD6- 8E 1A 08 3175          STX TRACK
0DD9- 20 90 08 3180 IOJMP    JSR CALLIO
0DDC- 4C 29 0A 3185          JMP PRINT.SCREEN.DATA
               3190 * ---------------------------------------
0DDF- EE 1B 08 3195 INC.SCT  INC SECTOR
0DE2- AE 1B 08 3200          LDX SECTOR
0DE5- EC 70 08 3205          CPX MAXSCT
0DE8- 90 EF    3210          BCC IOJMP
0DEA- A2 00    3215          LDX #0
0DEC- 8E 1B 08 3220          STX SECTOR
```

```
                    3225 * ----------------------------------------------
0DEF- EE 1A 08 3230 INC.TRK  INC TRACK
0DF2- AE 1A 08 3235          LDX TRACK
0DF5- EC 71 08 3240          CPX MAXTRK
0DF8- 90 DF    3245          BCC IOJMP
0DFA- A2 00    3250          LDX #0
0DFC- 8E 1A 08 3255          STX TRACK
0DFF- F0 D8    3260          BEQ IOJMP     ...ALWAYS
                    3265
                    3270 * ----------------------CURSOR MOVEMENT ROUTINE
                    3275
0E01- 20 A3 0A 3280 LEFT     JSR FIND.CURRENT.LINE
0E04- CE 34 08 3285          DEC CRSVAL
0E07- 4C 29 0E 3290          JMP CRS1
                    3295 * ----------------------------------------------
0E0A- 20 A3 0A 3300 RIGHT    JSR FIND.CURRENT.LINE
0E0D- EE 34 08 3305          INC CRSVAL
0E10- 4C 29 0E 3310          JMP CRS1
                    3315 * ----------------------------------------------
0E13- 20 A3 0A 3320 UP       JSR FIND.CURRENT.LINE
0E16- AD 34 08 3325          LDA CRSVAL
0E19- 38       3330          SEC
0E1A- E9 0D    3335          SBC #13
0E1C- B0 08    3340          BCS .2
0E1E- C9 FC    3345          CMP #$FC
0E20- 90 02    3350          BCC .1
0E22- E9 0E    3355          SBC #14
0E24- 69 04    3360 .1       ADC #4
0E26- 8D 34 08 3365 .2       STA CRSVAL
0E29- 20 CF 0A 3370 CRS1     JSR PRINT.OLD.LINE
0E2C- 20 CC 0A 3375          JSR PRINT.NEW.LINE
0E2F- 20 B3 10 3380          JSR PRTCRS
0E32- AE 6B 08 3385          LDX EDFLG
0E35- D0 32    3390          BNE PARSE2
0E37- 60       3395          RTS
                    3400
                    3405 * ----------------------------------------------
0E38- 20 A3 0A 3410 DOWN     JSR FIND.CURRENT.LINE
0E3B- AD 34 08 3415          LDA CRSVAL
0E3E- 18       3420          CLC
0E3F- 69 0D    3425          ADC #13
0E41- 90 08    3430          BCC .2
0E43- C9 04    3435          CMP #4
0E45- B0 02    3440          BCS .1
0E47- 69 0E    3445          ADC #14
0E49- 69 FB    3450 .1       ADC #$FB
0E4B- 8D 34 08 3455 .2       STA CRSVAL
0E4E- 4C 29 0E 3460          JMP CRS1
```

```
                    3465
                    3470 SET.HEX.EDIT
                    3475
0E51- A9 00         3480          LDA #0
0E53- 8D 6E 08      3485 SETMODE  STA EDIT.MODE.FLAG
0E56- 4C C9 0C      3490          JMP PROMPT
                    3495
                    3500 SET.ASCII.EDIT
                    3505
0E59- A9 03         3510          LDA #3
0E5B- D0 F6         3515          BNE SETMODE  ...Always
                    3520
                    3525
                    3530 * ---------------------------------------
0E5D- AD 1A 08      3535 PARSE    LDA TRACK
0E60- 8D 2C 08      3540          STA OLDTRK
0E63- AD 1B 08      3545          LDA SECTOR
0E66- 8D 2D 08      3550          STA OLDSCT
0E69- AE 72 08      3555 PARSE2   LDX SPECIAL.FUNCTION
0E6C- F0 0C         3560          BEQ .2
0E6E- CA            3565          DEX
0E6F- 8E 72 08      3570          STX SPECIAL.FUNCTION
0E72- AD 00 C0      3575 .1       LDA KEY
0E75- 10 FB         3580          BPL .1
0E77- 20 29 0A      3585          JSR PRINT.SCREEN.DATA
0E7A- 20 83 10      3590 .2       JSR INKEY
0E7D- A2 FD         3595          LDX #$FD
0E7F- E8            3600 .3       INX
0E80- E8            3605          INX
0E81- E8            3610          INX
0E82- BD 95 0E      3615          LDA VALID.CMND.TABLE,X
0E85- F0 0D         3620          BEQ .4
0E87- C5 E0         3625          CMP LOC
0E89- D0 F4         3630          BNE .3
0E8B- E8            3635          INX
0E8C- BD 96 0E      3640          LDA VALID.CMND.TABLE+1,X
0E8F- 48            3645          PHA
0E90- BD 95 0E      3650          LDA VALID.CMND.TABLE,X
0E93- 48            3655          PHA
0E94- 60            3660 .4       RTS          Bad Command
                    3665
                    3670 * ---------------------------------------
                    3675
                    3680 VALID.CMND.TABLE
0E95- C9            3685          .HS C9       I
0E96- 12 0E         3690          .DA UP-1
0E98- CA            3695          .HS CA       J
0E99- 00 0E         3700          .DA LEFT-1
```

```
0E9B- CB       3705    .HS CB       K
0E9C- 09 0E    3710    .DA RIGHT-1
0E9E- CD       3715    .HS CD       M
0E9F- 37 0E    3720    .DA DOWN-1
0EA1- 88       3725    .HS 88       <-
0EA2- 00 0E    3730    .DA LEFT-1
0EA4- 95       3735    .HS 95       ->
0EA5- 09 0E    3740    .DA RIGHT-1
0EA7- AC       3745    .HS AC       ,
0EA8- CC 0D    3750    .DA DEC.TRK-1
0EAA- AE       3755    .HS AE       .
0EAB- EE 0D    3760    .DA INC.TRK-1
0EAD- B1       3765    .HS B1       1
0EAE- B5 0D    3770    .DA FSET-1
0EB0- B2       3775    .HS B2       2
0EB1- B5 0D    3780    .DA FSET-1
0EB3- B3       3785    .HS B3       3
0EB4- B5 0D    3790    .DA FSET-1
0EB6- B4       3795    .HS B4       4
0EB7- B5 0D    3800    .DA FSET-1
0EB9- B5       3805    .HS B5       5
0EBA- B5 0D    3810    .DA FSET-1
0EBC- B6       3815    .HS B6       6
0EBD- B5 0D    3820    .DA FSET-1
0EBF- B7       3825    .HS B7       7
0EC0- B5 0D    3830    .DA FSET-1
0EC2- B8       3835    .HS B8       8
0EC3- B5 0D    3840    .DA FSET-1
0EC5- B9       3845    .HS B9       9
0EC6- B5 0D    3850    .DA FSET-1
0EC8- BC       3855    .HS BC       <
0EC9- CC 0D    3860    .DA DEC.TRK-1
0ECB- BE       3865    .HS BE       >
0ECC- EE 0D    3870    .DA INC.TRK-1
0ECE- C1       3875    .HS C1       A
0ECF- 58 0E    3880    .DA SET.ASCII.EDIT-1
0ED1- C4       3885    .HS C4       D
0ED2- A7 0D    3890    .DA SWT.DRV-1
0ED4- C8       3895    .HS C8       H
0ED5- 50 0E    3900    .DA SET.HEX.EDIT-1
0ED7- CC       3905    .HS CC       L
0ED8- C0 0D    3910    .DA DEC.SCT-1
0EDA- CE       3915    .HS CE       N
0EDB- DE 0D    3920    .DA INC.SCT-1
0EDD- D5       3925    .HS D5       U
0EDE- 99 0D    3930    .DA SET.HEX.OR.DEC-1
0EE0- B0       3935    .HS B0       0
0EE1- 3F 11    3940    .DA FILES-1
```

```
0EE3- 00       3945          .HS 00       EOT
               3950 * ---------------------------------------------
0EE4- AE 6E 08 3955 CTRLMV   LDX EDIT.MODE.FLAG
0EE7- F0 38    3960          BZR .4       HEX EDIT.
0EE9- C9 89    3965          CMP #CTRL.I
0EEB- D0 0A    3970          BNE .1
0EED- A9 40    3975          LDA #$40
0EEF- 8D 69 08 3980          STA OFFSET
0EF2- A9 06    3985          LDA #6       INVERSE
0EF4- 4C 53 0E 3990          JMP SETMODE
0EF7- C9 86    3995 .1       CMP #CTRL.F
0EF9- D0 0A    4000          BNE .2
0EFB- A9 80    4005          LDA #$80
0EFD- 8D 69 08 4010          STA OFFSET
0F00- A9 09    4015          LDA #9       FLASHING
0F02- 4C 53 0E 4020          JMP SETMODE
0F05- C9 8E    4025 .2       CMP #CTRL.N
0F07- D0 0A    4030          BNE .3
0F09- A9 00    4035          LDA #0
0F0B- 8D 69 08 4040          STA OFFSET
0F0E- A9 03    4045          LDA #3       NORMAL
0F10- 4C 53 0E 4050          JMP SETMODE
0F13- C9 8C    4055 .3       CMP #CTRL.L
0F15- D0 0A    4060          BNE .4
0F17- A9 20    4065          LDA #$20
0F19- 8D 69 08 4070          STA OFFSET
0F1C- A9 0C    4075          LDA #12      Lower Case
0F1E- 4C 53 0E 4080          JMP SETMODE
0F21- C9 8D    4085 .4       CMP #RETURN
0F23- D0 03    4090          BNE .5
0F25- 4C 0A 0E 4095          JMP RIGHT
0F28- C9 95    4100 .5       CMP #CTRL.U
0F2A- D0 03    4105          BNE .6
0F2C- 4C 0A 0E 4110          JMP RIGHT
0F2F- C9 88    4115 .6       CMP #CTRL.H
0F31- D0 03    4120          BNE .7
0F33- 4C 01 0E 4125          JMP LEFT
0F36- C9 91    4130 .7       CMP #CTRL.Q
0F38- D0 03    4135          BNE .8
0F3A- 4C 13 0E 4140          JMP UP
0F3D- C9 9A    4145 .8       CMP #CTRL.Z
0F3F- D0 03    4150          BNE .9
0F41- 4C 38 0E 4155          JMP DOWN
0F44- AE 6A 08 4160 .9       LDX FIRST
0F47- D0 01    4165          BNE .10
0F49- 60       4170          RTS
0F4A- C9 84    4175 .10      CMP #CTRL.D
0F4C- D0 0F    4180          BNE .12
```

```
0F4E- AE 34 08 4185          LDX CRSVAL
0F51- BD 01 09 4190 .11      LDA BUFFER+1,X
0F54- 9D 00 09 4195          STA BUFFER,X
0F57- E8       4200          INX
0F58- D0 F7    4205          BNE .11
0F5A- 4C 29 0A 4210          JMP PRINT.SCREEN.DATA
0F5D- C9 81    4215 .12      CMP #CTRL.A
0F5F- D0 17    4220          BNE .14
0F61- A2 FE    4225          LDX #$FE
0F63- CE 34 08 4230          DEC CRSVAL
0F66- BD 00 09 4235 .13      LDA BUFFER,X
0F69- 9D 01 09 4240          STA BUFFER+1,X
0F6C- CA       4245          DEX
0F6D- EC 34 08 4250          CPX CRSVAL
0F70- D0 F4    4255          BNE .13
0F72- EE 34 08 4260          INC CRSVAL
0F75- 4C 29 0A 4265          JMP PRINT.SCREEN.DATA
0F78- A2 01    4270 .14      LDX #1
0F7A- 8E 6B 08 4275          STX EDFLG
0F7D- 60       4280          RTS
               4285
               4290 * ---------------------------------------
               4295
0F7E- A2 FF    4300 EDIT     LDX #$FF
0F80- 8E 6A 08 4305          STX FIRST
0F83- E8       4310          INX
0F84- 8E 6B 08 4315          STX EDFLG    0 = EDIT ON
0F87- AE 35 08 4320          LDX FLTNUM
0F8A- 8E 30 08 4325          STX ON.OFF
0F8D- BD 8B 0C 4330          LDA FSTAT,X
0F90- D0 03    4335          BNE .1
0F92- 8D 35 08 4340          STA FLTNUM
0F95- 20 29 0A 4345 .1       JSR PRINT.SCREEN.DATA
0F98- 20 CC 0A 4350 .2       JSR PRINT.NEW.LINE
0F9B- 20 B3 10 4355 .3       JSR PRTCRS
0F9E- 20 83 10 4360          JSR INKEY
0FA1- C9 9B    4365          CMP #ESCAPE
0FA3- D0 16    4370          BNE .5
               4375
0FA5- AE 30 08 4380          LDX ON.OFF
0FA8- 8E 35 08 4385          STX FLTNUM
0FAB- A2 01    4390          LDX #1
0FAD- 8E 6B 08 4395          STX EDFLG    EDIT OFF
0FB0- AD 6E 08 4400          LDA EDIT.MODE.FLAG
0FB3- F0 05    4405          BZR .4
0FB5- A9 03    4410          LDA #3
0FB7- 8D 6E 08 4415          STA EDIT.MODE.FLAG
0FBA- 60       4420 .4       RTS
```

```
                4425
                4430 * CHECK FOR HEX OR ASCII EDIT
                4435
0FBB- AE 6E 08 4440 .5      LDX EDIT.MODE.FLAG
0FBE- D0 4A    4445         BNE .8
                4450
                4455 * HEX EDIT ROUTINE
                4460
0FC0- C9 A0    4465         CMP #SPACE
0FC2- B0 0F    4470         BCS .6
0FC4- 20 E4 0E 4475         JSR CTRLMV
0FC7- A2 FF    4480         LDX #$FF
0FC9- 8E 6A 08 4485         STX FIRST
0FCC- E8       4490         INX
0FCD- 8E 6B 08 4495         STX EDFLG
0FD0- 4C 98 0F 4500         JMP .2
0FD3- 20 54 10 4505 .6      JSR CKHEX
0FD6- C9 10    4510         CMP #16
0FD8- B0 C1    4515         BCS .3
0FDA- EE 6A 08 4520         INC FIRST
0FDD- D0 09    4525         BNE .7
0FDF- AE 34 08 4530         LDX CRSVAL
0FE2- 9D 00 09 4535         STA BUFFER,X
0FE5- 4C 98 0F 4540         JMP .2
0FE8- 85 E0    4545 .7      STA LOC
0FEA- AE 34 08 4550         LDX CRSVAL
0FED- BD 00 09 4555         LDA BUFFER,X
0FF0- 0A       4560         ASL
0FF1- 0A       4565         ASL
0FF2- 0A       4570         ASL
0FF3- 0A       4575         ASL
0FF4- 05 E0    4580         ORA LOC
0FF6- 9D 00 09 4585         STA BUFFER,X
0FF9- 20 A3 0A 4590         JSR FIND.CURRENT.LINE
0FFC- EE 34 08 4595         INC CRSVAL
0FFF- 20 CF 0A 4600         JSR PRINT.OLD.LINE
1002- A9 FF    4605         LDA #$FF
1004- 8D 6A 08 4610         STA FIRST
1007- 4C 98 0F 4615         JMP .2
                4620
                4625 * ASCII EDIT ROUTINE
                4630
100A- C9 A0    4635 .8      CMP #$A0
100C- B0 18    4640         BCS .10
100E- AE 33 08 4645         LDX USE.CTRL.CHARS
1011- F0 2F    4650         BZR .14
1013- 20 E4 0E 4655         JSR CTRLMV
1016- A2 00    4660         LDX #0
```

```
1018- EC 6B 08 4665          CPX EDFLG
101B- D0 03    4670          BNE .9
101D- 4C 98 0F 4675          JMP .2
1020- 8E 6B 08 4680 .9       STX EDFLG
1023- 4C 42 10 4685          JMP .14
1026- AE 69 08 4690 .10      LDX OFFSET
1029- E0 20    4695          CPX #$20      LOWER CASE?
102B- D0 0A    4700          BNE .11
102D- C9 C1    4705          CMP #$C1
102F- 90 11    4710          BCC .14       < "A"
1031- C9 DB    4715          CMP #$DB
1033- B0 0D    4720          BCS .14       > or = "["
1035- 90 08    4725          BCC .13       ...always
1037- C9 C0    4730 .11      CMP #$C0
1039- B0 03    4735          BCS .12       > = "@"
103B- 6D 69 08 4740          ADC OFFSET
103E- 18       4745 .12      CLC
103F- 6D 69 08 4750 .13      ADC OFFSET
1042- AE 34 08 4755 .14      LDX CRSVAL
1045- 9D 00 09 4760          STA BUFFER,X
1048- 20 A3 0A 4765          JSR FIND.CURRENT.LINE
104B- EE 34 08 4770          INC CRSVAL
104E- 20 CF 0A 4775          JSR PRINT.OLD.LINE
1051- 4C 98 0F 4780          JMP .2
               4785
               4790 * ---------------------------------------------
               4795
1054- C9 B0    4800 CKHEX    CMP #$B0      "0"
1056- 90 10    4805          BCC .3        < "0"
1058- C9 C7    4810          CMP #$C7
105A- B0 0C    4815          BCS .3        > "F"
105C- C9 BA    4820          CMP #$BA
105E- 90 06    4825          BCC .2        < "10"
1060- C9 C1    4830          CMP #$C1
1062- 90 04    4835          BCC .3        >= "A"
1064- E9 07    4840          SBC #7
1066- 29 0F    4845 .2       AND #$0F
1068- 60       4850 .3       RTS
               4855
               4860 * ----------------------Flashing cursor routine
               4865
1069- AE 34 08 4870 NOPRESS  LDX CRSVAL
106C- BD 00 09 4875          LDA BUFFER,X
106F- 48       4880          PHA
1070- A9 20    4885          LDA #$20
1072- 20 9A 10 4890          JSR WAIT.FOR.KEY
1075- A9 A0    4895          LDA #SPACE
1077- 20 9A 10 4900          JSR WAIT.FOR.KEY
```

```
107A- A2 01    4905          LDX #1
107C- 8E 6F 08 4910          STX KEYFLG
107F- 68       4915          PLA
1080- 20 9A 10 4920          JSR WAIT.FOR.KEY
1083- A2 00    4925 INKEY    LDX #0
1085- 8E 6F 08 4930          STX KEYFLG
1088- AD 00 C0 4935 OUTKEY   LDA KEY
108B- 10 DC    4940          BPL NOPRESS
108D- 8D 10 C0 4945          STA STROBE
1090- 85 E0    4950          STA LOC
1092- 85 E1    4955          STA LOC+1
1094- A2 01    4960          LDX #1
1096- 8E 6F 08 4965          STX KEYFLG
1099- 60       4970          RTS
               4975
               4980 * ---------------------------------------
               4985
               4990 WAIT.FOR.KEY
               4995
109A- AE 34 08 5000          LDX CRSVAL
109D- 9D 00 09 5005          STA BUFFER,X
10A0- 20 CC 0A 5010          JSR PRINT.NEW.LINE
10A3- A9 3C    5015          LDA #60
10A5- AA       5020 .1       TAX
10A6- AC 00 C0 5025 .2       LDY KEY
10A9- 30 07    5030          BMI .3
10AB- CA       5035          DEX
10AC- D0 F8    5040          BNE .2
10AE- E9 01    5045          SBC #1
10B0- D0 F3    5050          BNE .1
10B2- 60       5055 .3       RTS
               5060
               5065 * ---------------------------------------
               5070
10B3- A9 15    5075 PRTCRS   LDA #21
10B5- 20 8F 0A 5080          JSR FIND.BASE.ADDR
10B8- A0 1E    5085          LDY #30
10BA- AD 34 08 5090          LDA CRSVAL
10BD- 20 D1 10 5095          JSR PRINT.HEX.OR.DECIMAL
10C0- AE 6D 08 5100          LDX SPACES
10C3- F0 08    5105          BEQ .7
10C5- A9 A0    5110 .6       LDA #SPACE
10C7- 91 28    5115          STA (BASE1),Y
10C9- C8       5120          INY
10CA- CA       5125          DEX
10CB- D0 F8    5130          BNE .6
10CD- 60       5135 .7       RTS
               5140
```

```
                    5145 * ---------------------------------------
                    5150
                    5155 PRINT.HEX.DEC
                    5160
10CE- AD 2B 08      5165          LDA BYTE
                    5170
                    5175 PRINT.HEX.OR.DECIMAL
                    5180
10D1- 48            5185          PHA
10D2- AE 2F 08      5190          LDX HEX.OR.DEC.FLG
10D5- D0 2A         5195          BNE PRINT.DECIMAL
10D7- 8E 6D 08      5200          STX SPACES
                    5205
                    5210 * ---------------------------------------
                    5215
                    5220 PRINT.HEX.BYTE
                    5225
10DA- A9 A4         5230          LDA #$A4
10DC- 91 28         5235          STA (BASE1),Y
10DE- C8            5240          INY
10DF- 68            5245          PLA
10E0- 48            5250          PHA
10E1- 4A            5255          LSR
10E2- 4A            5260          LSR
10E3- 4A            5265          LSR
10E4- 4A            5270          LSR
10E5- 09 B0         5275          ORA #$B0
10E7- C9 BA         5280          CMP #$BA
10E9- 90 02         5285          BCC .1
10EB- 69 06         5290          ADC #$06
10ED- 91 28         5295 .1       STA (BASE1),Y
10EF- C8            5300          INY
10F0- 68            5305          PLA
10F1- 29 0F         5310          AND #$0F
10F3- 09 B0         5315          ORA #$B0
10F5- C9 BA         5320          CMP #$BA
10F7- 90 02         5325          BCC .2
10F9- 69 06         5330          ADC #$06
10FB- 91 28         5335 .2       STA (BASE1),Y
10FD- C8            5340          INY
10FE- 84 24         5345          STY CH
1100- 60            5350          RTS
                    5355 * ---------------------------------------
                    5360
                    5365 PRINT.DECIMAL
                    5370
1101- A2 02         5375          LDX #2
1103- 8E 6D 08      5380          STX SPACES
```

```
1106- A2 B0    5385          LDX #$B0
1108- 68       5390          PLA
1109- C9 64    5395          CMP #100
110B- 90 12    5400          BCC .2
110D- E8       5405 .1       INX
110E- E9 64    5410          SBC #100
1110- C9 64    5415          CMP #100
1112- B0 F9    5420          BCS .1
1114- CE 6D 08 5425          DEC SPACES
1117- 48       5430          PHA
1118- 8A       5435          TXA
1119- 91 28    5440          STA (BASE1),Y
111B- C8       5445          INY
111C- A2 B0    5450          LDX #$B0
111E- 68       5455          PLA
111F- C9 0A    5460 .2       CMP #10
1121- 90 0A    5465          BCC .4
1123- E8       5470 .3       INX
1124- E9 0A    5475          SBC #10
1126- C9 0A    5480          CMP #10
1128- B0 F9    5485          BCS .3
112A- CE 6D 08 5490          DEC SPACES
112D- 48       5495 .4       PHA
112E- AD 6D 08 5500          LDA SPACES
1131- C9 02    5505          CMP #2
1133- F0 04    5510          BEQ .5
1135- 8A       5515          TXA
1136- 91 28    5520          STA (BASE1),Y
1138- C8       5525          INY
1139- 68       5530 .5       PLA
113A- 09 B0    5535          ORA #$B0
113C- 91 28    5540          STA (BASE1),Y
113E- C8       5545          INY
113F- 60       5550          RTS
               5555
               5560 * ----------------------------------------
               5565
1140- A2 15    5570 FILES    LDX #21
1142- 86 23    5575          STX WNDBTM
1144- A2 00    5580          LDX #0
1146- 8E 6D 08 5585          STX SPACES
1149- E8       5590          INX
114A- 8E 72 08 5595          STX SPECIAL.FUNCTION
114D- 20 58 FC 5600          JSR HOME
1150- E8       5605          INX
1151- 20 4A F9 5610          JSR PRBLANK
1154- AD 01 09 5615          LDA BUFFER+1
1157- 20 06 12 5620          JSR HEX2
```

```
115A- AD 02 09 5625          LDA BUFFER+2
115D- 20 06 12 5630          JSR HEX2
1160- 20 62 FC 5635          JSR CR.LF
1163- 20 62 FC 5640          JSR CR.LF
1166- A2 0B    5645          LDX #$0B
1168- A0 02    5650 .1       LDY #2
116A- 20 62 FC 5655          JSR CR.LF
116D- 20 09 12 5660          JSR SPCOUT
1170- BD 00 09 5665 .2       LDA BUFFER,X
1173- 20 06 12 5670          JSR HEX2
1176- E8       5675          INX
1177- 88       5680          DEY
1178- D0 F6    5685          BNE .2
117A- BD 00 09 5690          LDA BUFFER,X
117D- E8       5695          INX
117E- 2A       5700          ROL
117F- 48       5705          PHA
1180- 90 08    5710          BCC .3
1182- A9 AA    5715          LDA #STAR
1184- 20 ED FD 5720          JSR COUT
1187- 4C 8D 11 5725          JMP .4
118A- 20 09 12 5730 .3       JSR SPCOUT
118D- A0 00    5735 .4       LDY #0
118F- 68       5740          PLA
1190- 4A       5745          LSR
1191- F0 04    5750          BEQ .6
1193- C8       5755 .5       INY
1194- 4A       5760          LSR
1195- 90 FC    5765          BCC .5
1197- B9 D2 11 5770 .6       LDA TYPE,Y
119A- 20 ED FD 5775          JSR COUT
119D- 20 09 12 5780          JSR SPCOUT
11A0- A0 1E    5785          LDY #30
11A2- 8C 6C 08 5790          STY HCOUNT
11A5- BD 00 09 5795 .7       LDA BUFFER,X
11A8- 85 E0    5800          STA LOC
11AA- 4A       5805          LSR
11AB- 4A       5810          LSR
11AC- 4A       5815          LSR
11AD- 4A       5820          LSR
11AE- 4A       5825          LSR
11AF- A8       5830          TAY
11B0- B1 E9    5835          LDA (CFLT),Y
11B2- 29 F0    5840          AND #$F0
11B4- 18       5845          CLC
11B5- 65 E0    5850          ADC LOC
11B7- C9 80    5855          CMP #CTRL.AT change
11B9- 30 06    5860          BMI .8       control
```

```
11BB- C9 A0    5865          CMP #SPACE   characters
11BD- 10 02    5870          BPL .8       to a
11BF- A9 AE    5875          LDA #PERIOD  period.
11C1- 20 ED FD 5880 .8       JSR COUT
11C4- E8       5885          INX
11C5- CE 6C 08 5890          DEC HCOUNT
11C8- D0 DB    5895          BNE .7
11CA- E8       5900          INX
11CB- E8       5905          INX
11CC- D0 9A    5910          BNE .1
11CE- CA       5915          DEX
11CF- 86 E4    5920          STX BUFFER.POINTER
11D1- 60       5925          RTS
11D2- D4 C9 C1
11D5- C2 D3 D2
11D8- C1 C2    5930 TYPE     .AS -"TIABSRAB"
               5935
               5940 * ------------------------Filter used by BASIC
               5945
11DA- AD 2B 08 5950 ASCPRINT LDA BYTE
11DD- C9 FF    5955          CMP #$FF
11DF- D0 05    5960          BNE .1
11E1- A9 A0    5965          LDA #$A0
11E3- 8D 2B 08 5970          STA BYTE
11E6- 4A       5975 .1       LSR
11E7- 4A       5980          LSR
11E8- 4A       5985          LSR
11E9- 4A       5990          LSR
11EA- 4A       5995          LSR
11EB- A8       6000          TAY
11EC- B9 F6 11 6005          LDA ASCFD,Y
11EF- 18       6010          CLC
11F0- 6D 2B 08 6015          ADC BYTE
11F3- 4C ED FD 6020          JMP COUT
11F6- C0 80 80
11F9- 40 40 00
11FC- 00 C0    6025 ASCFD    .HS C08080404000000C0
               6030
11FE- A9 A4    6035 HEX0     LDA #$A4     "$"
1200- 20 ED FD 6040          JSR COUT
1203- AD 2B 08 6045 HEXPRINT LDA BYTE
1206- 20 DA FD 6050 HEX2     JSR PRHEX
1209- A9 A0    6055 SPCOUT   LDA #SPACE
120B- 4C ED FD 6060          JMP COUT
               6065
               6070 * ------------------------Print Hex or Decimal
               6075
120E- AE 2F 08 6080 HXBYTE   LDX HEX.OR.DEC.FLG
```

```
1211- F0 EB    6085          BEQ HEX0      0 = HEX
1213- AE 2B 08 6090          LDX BYTE
1216- A9 00    6095          LDA #0
1218- 20 24 ED 6100          JSR LINPRT
121B- 4C 09 12 6105          JMP SPCOUT
               6110
               6115 * ----------------------------------------
               6120
121E- 00       6125          .HS 00
121F- 00 00    6130 STOP     .HS 0000
               6135
               6140 * ----------------------------------------
```

►DiskView

By Charles Haight

This program is called DiskView. DiskView is a mini "nibbler." It will read the raw nibbilized data from a disk without regard to disk format.

This means data can be viewed on a nonstandard format disk (copy-protected) as easily as from a normal DOS formatted disk. With DiskView, a nonstandard disk can be examined to see what was changed. Often these changes are minor and a similar change can be made to your DOS. This would allow use of DiskEdit to read that disk.

To understand these changes lets examine the data pattern on a normal DOS 16 disk.

DOS formats a track by first writing a unique byte called a "sync byte." This byte (normally $FF) allows the Disk II hardware to synchronize with the data on the disk. DOS then writes an address field, some more sync bytes and the data field. At this time the data field is full of $00s. DOS goes on to write sixteen sets of address and data fields on each track. These sets of address and data fields are called sectors.

The following is a normal address field for 3.3 DOS:

D5AA96FFFEAABBAEAAFBEFDEAAEB

It can be broken down into:

Start of address	D5 AA 96
Volume number	FF FE
Track	AA BB
Sector	AE AA
Checksum	FB EF
End of address	DE AA EB

The volume, track, sector and checksum are in a 4+4 coded format. This means that 4 bits in each byte are actual data. The first byte is rotated left and logically ANDed with the second byte to recover the data.

The data field consists of:

Start of data	D5 AA AD
Encoded data	(341 bytes)
Checksum	(1 byte)
End of data	DE AA EB

The data field is encoded in a 2+6 format. Six bits of each byte are valid data.

The basic structure of 3.2 DOS is similar to 3.3 DOS with these notable exceptions:

1. When initializing a disk, DOS 3.2 does not write a blank

data sector. Instead it just writes enough $FFs to fill the space a data sector would use. Trying to read a track/sector that has never been written to will always generate I/O errors.

2. The data is encoded in a 3+5 format which requires 410 bytes to encode 256 data bytes. This is one reason why there are only 13 sectors.

About the program

The format of DiskView is similar to DiskEdit. A full screen of hexadecimal bytes is displayed with the status prompts at the bottom of the screen. The buffer extends from $2000 to $4000 hex which is large enough to ensure reading in an entire track. The slot, drive and track are selectable. Half-tracks can be accessed by appending a ".5" to the track number. The commands are:

D - change the drive
L - read last track (steps by half tracks)
N - read next track (steps by half tracks)
P - print screen contents
R - read the current track
S - change the slot
T - select a track or half track
X - exit to basic
→ - increment buffer
← - decrement buffer

Type in the program and save it to disk. Be especially careful with the data statements. When those values are poked into memory they become a machine language subroutine that is the heart of the program. Run the program. When the COMMAND prompt flashes, press the R key. The screen will fill with hex bytes that show the data stored on the disk.

CAUTION: Utility Nibbler is DOS dependent. It calls directly into DOS to step the drive motor. DOS 3.3 and 48K of memory are needed. This program can be used to read 13 or 16-sector disks or any other Apple disk, but it will only run on a 48K Apple][(+) with 3.3 DOS.

The program

```
10 TEXT : HOME : IN# 0: PR# 0: LOMEM: 16384: POKE 1144,90: GOTO 90
20 KY% = PEEK ( - 16384): IF KY% < 128 THEN 20
30 POKE - 16368,0: RETURN
40 FOR X = 1 TO 40: PRINT "-";: NEXT : RETURN
50 GOSUB 60: POKE 781,0: POKE 1144,90: POKE TR%,0: CALL IO%: POKE 781,255:
    POKE TR%,TK%: CALL IO%: RETURN
60 VTAB 23: HTAB 2: INVERSE : PRINT "SLOT";: HTAB 10: PRINT "DRIVE";: HTAB
    19: PRINT "TRACK";: NORMAL
```

```
70 VTAB 23: HTAB 7: PRINT PEEK (S1%) / 16;: HTAB 16: PRINT PEEK (DR%) - PEEK
     (S1%);: HTAB 25: PRINT "^^^^^"B$B$ B$B$ PEEK (TR%) / 2
80 RETURN
90 GOSUB 540
100 IN% = PEEK (CT%): VTAB 21: HTAB 32: PRINT "PAGE^" IN% - 31: GOSUB 60:
     VTAB 23: HTAB 30: CALL - 868: FLASH : PRINT ">COMMAND<": NORMAL :
     GOSUB 20
110 IF KY% = 210 THEN GOSUB 480
120 IF KY% = 211 THEN GOSUB 390
130 IF KY% = 216 THEN GOSUB 410
140 IF KY% = 212 THEN GOSUB 420
150 IF KY% = 199 THEN GOSUB 270
160 IF KY% = 196 THEN GOSUB 230
170 IF KY% = 208 THEN GOSUB 290
180 IF KY% = 136 THEN GOSUB 250
190 IF KY% = 149 THEN GOSUB 370
200 IF KY% = 204 THEN GOSUB 490
210 IF KY% = 206 THEN GOSUB 510
220 GOTO 100
230 VTAB 23: HTAB 30: INVERSE : PRINT G$"SET^DRIVE";: HTAB 10: FLASH :
     PRINT "DRIVE";: NORMAL : HTAB 16: PRINT "^" CHR$ (8);: GET A$:DR = VAL
     (A$): IF DR < 1 OR DR > 2 THEN 230
240 POKE DR%, PEEK (S1%) + DR: GOTO 50
250 IN% = IN% - 1: IF IN% < 32 THEN IN% = 32
260 POKE CT%, IN%: CALL MV%: RETURN
270 PRINT G$: IF G$ = CHR$ (7) THEN G$ = "": RETURN
280 IF G$ = "" THEN G$ = CHR$ (7): RETURN
290 VTAB 23: HTAB 30: FLASH : PRINT G$">PRINTER<";: NORMAL
300 PR# 1
310 BUFFER% = PEEK (CT%) * 256
320 PRINT : PRINT "TRACK^"TK%
330 FOR X = 0 TO 255 STEP 13: FOR Y = 0 TO 12: POKE NM%, PEEK (BUFFER% + X +
     Y): CALL HX%: PRINT "^";: NEXT Y: PRINT
340 IF PEEK ( - 16384) = 155 THEN 360
350 NEXT X
360 PR# 0: POKE - 16368,0: RETURN
370 IN% = IN% + 1: IF IN% > 63 THEN IN% = 63
380 POKE CT%, IN%: CALL MV%: RETURN
390 VTAB 23: HTAB 30: INVERSE : PRINT G$"NEW^SLOT?";: HTAB 2: FLASH : PRINT
     "SLOT";: NORMAL : HTAB 7: PRINT "^" CHR$ (8);: GET A$:KY% = VAL (A$):
     IF KY% < 1 OR KY% > 7 THEN 390
400 POKE S1%,KY% * 16: POKE S2%,KY% * 16: GOTO 240
410 TEXT : HOME : POKE 33,33: CALL 1002: END
420 C$ = "": VTAB 23: HTAB 30: INVERSE : PRINT "SET^TRACK";: HTAB 19: FLASH
     : PRINT G$"TRACK";: NORMAL : PRINT "^^^^" CHR$ (8) CHR$ (8) CHR$ (8);:
     GET A$:C$ = C$ + A$: PRINT A$;: GET A$:C$ = C$ + A$: IF A$ = CHR$ (13)
     THEN 460
430 PRINT A$;
```

```
440 GET A$:C$ = C$ + A$: PRINT A$;
450 IF A$ = "." THEN GET A$:C$ = C$ + A$: PRINT A$;
460 KY = VAL (C$): IF KY < 0 OR KY > 35 THEN 420
470 TK% = KY * 2
480 POKE CT%,32: VTAB 23: HTAB 30: FLASH : PRINT ">>>READ<<<"G$;: NORMAL :
    PRINT "^";: POKE TR%,TK%: GOSUB 70: CALL IO%: GOTO 60
490 TK% = TK% - 1: IF TK% < 0 THEN TK% = 71
500 GOTO 480
510 TK% = TK% + 1: IF TK% > 71 THEN TK% = 0
520 GOTO 480
530 STOP
540 FOR X = 768 TO 894: READ X%: POKE X,X%: NEXT X
550 DATA162,97,189,137,192,162, 96,189,137,192,160,5,169,255,32,168,
    252,136,16,248,169,0,32,160,185,189,142,192,169,0,133,30,169,32
    ,133,31,162,96,160,0,189,140,192,16,251,145,30,230,30,
    208,245,230,31,165,31,201,64,144,237
560 DATA189,136,192,169,1,133, 37,32,34,252,169,0,133,36,133,30,169,
    13,133,31,162,1,32,74,249,166,30,189,
    0,32,32,218,253,162,1,32,74,249,230,30,240,7,198,31,208,235,76,
    75,3,32,156,252,230,37,32,34,252,169,22
570 DATA 133,34,96,169,172,32, 218,253,96
580 S1% = 774:S2% = 805:DR% = 769:TR% = 789:MV% = 830:CT% = 856:B$ = CHR$
    (8):G$ = CHR$ (7):IO% = 768:NM% = 890:HX% = 889:DR = 1
590 GOSUB 40: VTAB 8: HTAB 10: PRINT "COPYRIGHT^1981^(C)": PRINT : HTAB
    10: PRINT "ALL^RIGHTS^RESERVED": PRINT : HTAB 10: PRINT
    "HARDCORE^COMPUTING": PRINT : HTAB 10: PRINT "P.O.^BOX^110846":
    PRINT : HTAB 10: PRINT "TACOMA,^WA^98411"
600 VTAB 22: GOSUB 40: GOTO 60
```

4 plus 4 Conversion Chart

AA+AA=00	AA+AB=01	AA+AE=04	AA+AF=05
AA+BA=10	AA+BB=11	AA+BE=14	AA+BF=15
AA+EA=40	AA+EB=41	AA+EE=44	AA+EF=45
AA+FA=50	AA+FB=51	AA+FE=54	AA+FF=55
AB+AA=02	AB+AB=03	AB+AE=06	AB+AF=07
AB+BA=12	AB+BB=13	AB+BE=16	AB+BF=17
AB+EA=42	AB+EB=43	AB+EE=46	AB+EF=47
AB+FA=52	AB+FB=53	AB+FE=56	AB+FF=57
AE+AA=08	AE+AB=09	AE+AE=0C	AE+AF=0D
AE+BA=18	AE+BB=19	AE+BE=1C	AE+BF=1D
AE+EA=48	AE+EB=49	AE+EE=4C	AE+EF=4D
AE+FA=58	AE+FB=59	AE+FE=5C	AE+FF=5D
AF+AA=0A	AF+AB=0B	AF+AE=0E	AF+AF=0F
AF+BA=1A	AF+BB=1B	AF+BE=1E	AF+BF=1F
AF+EA=4A	AF+EB=4B	AF+EE=4E	AF+EF=4F
AF+FA=5A	AF+FB=5B	AF+FE=5E	AF+FF=5F
BA+AA=20	BA+AB=21	BA+AE=24	BA+AF=25
BA+BA=30	BA+BB=31	BA+BE=34	BA+BF=35
BA+EA=60	BA+EB=61	BA+EE=64	BA+EF=65
BA+FA=70	BA+FB=71	BA+FE=74	BA+FF=75
BB+AA=22	BB+AB=23	BB+AE=26	BB+AF=27
BB+BA=32	BB+BB=33	BB+BE=36	BB+BF=37
BB+EA=62	BB+EB=63	BB+EE=66	BB+EF=67
BB+FA=72	BB+FB=73	BB+FE=76	BB+FF=77
BE+AA=28	BE+AB=29	BE+AE=2C	BE+AF=2D
BE+BA=38	BE+BB=39	BE+BE=3C	BE+BF=3D
BE+EA=68	BE+EB=69	BE+EE=6C	BE+EF=6D
BE+FA=78	BE+FB=79	BE+FE=7C	BE+FF=7D
BF+AA=2A	BF+AB=2B	BF+AE=2E	BF+AF=2F
BF+BA=3A	BF+BB=3B	BF+BE=3E	BF+BF=3F
BF+EA=6A	BF+EB=6B	BF+EE=6E	BF+EF=6F
BF+FA=7A	BF+FB=7B	BF+FE=7E	BF+FF=7F
EA+AA=80	EA+AB=81	EA+AE=84	EA+AF=85
EA+BA=90	EA+BB=91	EA+BE=94	EA+BF=95
EA+EA=C0	EA+EB=C1	EA+EE=C4	EA+EF=C5
EA+FA=D0	EA+FB=D1	EA+FE=D4	EA+FF=D5
EB+AA=82	EB+AB=83	EB+AE=86	EB+AF=87
EB+BA=92	EB+BB=93	EB+BE=96	EB+BF=97
EB+EA=C2	EB+EB=C3	EB+EE=C6	EB+EF=C7
EB+FA=D2	EB+FB=D3	EB+FE=D6	EB+FF=D7
EE+BA=98	EE+BB=99	EE+BE=9C	EE+BF=9D
EE+EA=C8	EE+EB=C9	EE+EE=CC	EE+EF=CD
EE+FA=D8	EE+FB=D9	EE+FE=DC	EE+FF=DD
EF+BA=9A	EF+BB=9B	EF+BE=9E	EF+BF=9F
EF+EA=CA	EF+EB=CB	EF+EE=CE	EF+EF=CF
EF+FA=DA	EF+FB=DB	EF+FE=DE	EF+FF=DF
FA+EA=E0	FA+EB=E1	FA+EE=E4	FA+EF=E5
FA+FA=F0	FA+FB=F1	FA+FE=F4	FA+FF=F5
FB+EA=E2	FB+EB=E3	FB+EE=E6	FB+EF=E7
FB+FA=F2	FB+FB=F3	FB+FE=DE	FB+FF=DF
FE+EA=E8	FE+EB=E9	FE+EE=EC	FE+EF=ED
FE+FA=F8	FE+FB=F9	FE+FE=FC	FE+FF=FD
FF+EA=EA	FF+EB=EB	FF+EE=EE	FF+EF=EF
FF+FA=FA	FF+FB=FB	FF+FE=FE	FF+FF=FF

►Egbert II Communications Disk

(RTTY/CW/TRANSFER)
Egbert Software
W.H. Nail Co.

Requirements:
Apple][Plus, //e, or compatible
DOS 3.3 Master Disk
Egbert II Communications Disk
DEMUFFIN program (see Muffins)
Blank disk

By Keith S. Goldstein, MD

Since I haven't read anything about the Egbert II disk, other than the ad marketing it, I'll assume that not too many people are aware of the ingenious ideas that are packed into this system disk. But before I show you how to crack and modify the disk, I'll describe and explain the system a bit. This is only a very brief overview and isn't meant to be comprehensive. The disk is chock full of pleasant surprises.

The Egbert II Communications disk contains three very powerful main programs. The RTTY (Radio Teletype) program receives and transmits radio teletype signals. It generates RTTY tones on transmit and decodes the RTTY tones on receive. Some other goodies it has are a "Mailbox" option and an audio frequency counter option.

The CW (Continuous Waves) program does the same for Morse Code, while the Transfer program allows you to send and receive Applesoft, Integer and Binary programs over the telephone or radio. The special attraction is that all of the tone generation and decoding is done from within the program, so there is NO HARDWARE INTERFACE REQUIRED!

The cassette I/O plugs are used from the rear of the computer. Simply plug the cassette input into the speaker/earphone jack of any communications receiver (or telephone amplifier for the Transfer program) and plug the cassette output into the microphone jack of the transceiver. That's all you need to send/receive RTTY or CW.

For the non-amateur radio operator, you can use the RTTY program to receive foreign and domestic wire news services and telegrams such as those supplied by UPI.

The CW (Morse Code) program will decode or send Morse Code at rates from three to 125 words per minute. It is a great teacher for those interested in learning Morse Code or those who simply want to eavesdrop on radio hams.

Both the RTTY and CW programs use the on-board speaker-to-monitor arrangement. The Transfer program will work just as well with any transceiver, or you can transfer programs over the telephone without a modem! All you need is a cheap amplifier (like the Radio Shack 277-1008 which costs $11.00) and a telephone pick-up coil (also available at the 'Shack for about $2.00). It sure beats the price of a modem!

Now that your mouth is watering at the possibilities of getting the news and listening in on private and government teletype communications without messing around with any extra hardware, order one! I heartily recommend this disk. It's worth every penny.

Unfortunately, once you have the disk you will find some unfriendly little annoyances programmed-in there. Haven't you ever wished that you could go from receive to transmit RTTY without that darn CW (Morse Code) identifier breaking your concentration? Doesn't having your name and serial number flashed at you constantly annoy you? Wouldn't you just love to have the programs load super fast by using a speedy DOS? Wouldn't you like to be able to modify the programs to your heart's content? Wouldn't you just like to have a backup copy and don't have a nibble-copier? You can find out how to do these things and more below.

The Lock

The Egbert II Communications Disk uses several simple and yet very effective tricks to prevent the user from discovering its secrets. The major copy-protection scheme it incorporates is its DOS and the way the disk is initialized. It won't allow any standard copy programs or nibble-copiers (without changing parameters) to duplicate it.

To unprotect the programs on the original disk, each one must be loaded by the Egbert DOS and saved by a normal DOS onto a standard disk. After you have transferred the programs they will all, eventually, bomb into the monitor because the author included some checking routines to be sure that you are using his custom DOS. We will defeat those routines, too.

The author was quite thorough in his protection scheme. It is impossible to stop the computer by using reset or any normal method. Egbert DOS is a standard 3.2 with many modifications and patches and the author patched over the INIT command with his own routines. Among other things, this patch will set the Run Flag ($D6) to FF and disable the CATALOG, INT, and FP commands at every disk access (pretty shrewd, eh?) Also, since the programs must access normal DOS disks, Egbert has the normal DOS routines loaded and moved into place immediately after any of the programs have been loaded. This makes it

impossible to use the resident DOS to access the Egbert disk for the purpose of transferring the programs once any of them starts running.

These problems can be solved by using a modification of the DOS 3.3 Master Disk program called MUFFIN. The modified MUFFIN is called DEMUFFIN PLUS.

As you recall, MUFFIN is a machine-language program which will transfer programs or files from DOS 3.2 to DOS 3.3. In general, it reads from one disk format and writes to a different disk format. The modification to MUFFIN allows it to use whatever DOS is present in the machine to read from the locked disk and to write the file out onto a standard DOS 3.3 disk. This gem is just what is needed to transfer the Egbert files to a DOS 3.3 disk.

The Softkey

Here are the steps to follow in order to transfer the Egbert files to a standard DOS 3.3 disk:

1) Boot the system master and format a blank disk

INIT HELLO

2) Delete the HELLO program

DELETE HELLO

3) Load DEMUFFIN PLUS in a safe place where the boot won't mess it up

BLOAD DEMUFFIN PLUS, A$6000

The Egbert DOS will "lock you out" of the machine once it is loaded so we will have to allow the Egbert DOS to load in and then we will have to stop it before it initializes itself (i.e: takes over). This can best be done by a technique called Boot-Tracing. The process takes a little time but the satisfaction and knowledge gained is well worth the effort.

In general, this technique involves loading a chunk or stage of the boot into memory, examining it, moving it to a safe place in RAM, modifying it to work at the new location and stopping the boot (after loading each new stage) so that we will always be in control of the computer. In this way, the Egbert DOS can be allowed to fully load itself and then be forced to halt.

4) Put the Egbert disk in Drive 1, Slot 6 and enter the monitor

CALL -151

5) Move the bootcode in the controller card to RAM

8600<C600.C6FFM

6) Make the moved bootcode JuMP into the monitor after loading track 0, sector 0

***86F8:4C 59 FF N 8600G**

The Drive will stay on for the remainder of this process.

7) Move the first boot stage to a new location

8000<800.9FFM

8) Now we must change a few locations so it will work at this new location

8003:BD 00 80

9) Make this new stage JuMP into the monitor when finished

8049:4C 59 FF

10) Now we have to tell the first stage where our new second stage has been moved to

86F8:4C 01 80

11) Load the third stage of the boot

8600G

12) Since the last stage ended with a JuMP to location $301, we know where this third stage of the boot was just loaded. To be certain that it won't be over-written by the next stage, we will move it to a safe place

8300<300.3FFM

13) Again we have to change a few locations so that this stage will function properly at this new location in memory

8313:AD CC 83
833C:AD CC 83

14) The jump out of the fourth stage is not immediate, but only after many jumps to a certain subroutine does it continue on to the next stage of the boot. Therefore, we'll place a short program for this stage to jump to. We will also check it to see if it is going to the subroutine again (and if so, let the program continue) or if not, then stop and JuMP into the monitor. We will place our little program at $8400 but we need to intercept the program to JuMP to our little routine.

8343:4C 00 84

15) Enter this little routine

8400:A5 3E C9 D5 D0 03 6C 3E
8408:00 4C 59 FF

16) Now we mustn't forget to let our stage three know where this stage four was moved to so that it will be able to continue to load another chunk of the DOS for us

8049:4C 01 83

17) At this point we will let the computer use all of our routines to load in stage four of the boot

8600G

18) Now we've got almost all of the DOS loaded. Let's see where the final stage has been loaded

83CC

(The number you should see is $B6. Add 1 to it ($B6+1) = $B700; therefore, our next JuMP will be to $B700.)
19) Since we know where this last portion has been loaded, we are ready to complete the boot and have it stop just before it begins to start up the DOS. Let's move this fourth stage out of the way.

5700<B700.BFFFM

20) Now, we see the familiar DOS initialization routine JuMP near the beginning of all this stuff we have just moved. Once it has finished loading itself into the machine, let's have it JuMP into the monitor instead of starting the EGBERT DOS

5747:4C 59 FF

21) We also must not forget to let the previous third stage boot know where we have moved this final stage to

8409:4C 00 57

22) We are now ready to allow the entire EGBERT DOS to be read into the machine and it will stop just before it can take control, which is exactly what we want!

8600G

(The disk will stop spinning now since the boot has finished.)
23) Since we stopped the EGBERT DOS from being able to initialize itself, it wasn't able to fill-in its page-3 vector table. In order for our previously entered DEMUFFIN PLUS to function, it needs these vectors intact. This can be easily accomplished since the page-3 vector table image already exists within the Egbert DOS image. Just move it to page-3

3D0<9E51.9E7EM

24) Move the DEMUFFIN PLUS program back to $803 and start it running

```
803<6000.8000M
803G
```

25) Select Convert Files from the menu. For "File Name?" enter "=" (The equals sign is the Wildcard character). Transfer all files from the original disk to the standard initialized DOS 3.3 disk.

(Do not attempt to transfer the first seven of those files shown in INVERSE as they are DUMMY FILES and will cause errors if you try to copy them.)

Fixing the Files

Now that you have all of the programs on a standard DOS 3.3 disk, you are ready to remove the checks for the non-standard DOS so they will function correctly. Most of the changes that will be made will remove a POKE 214,255 that sets the Run Flag.

26) Boot your DOS 3.3 Master Disk. Remove it and insert your new Egbert DOS 3.3 disk
27) Load and modify the HELLO program

```
LOAD HELLO
2 INVERSE : FOR I = 1 TO 40 : PRINT "@" ; : NEXT :
    VTAB 15 : FOR I = 1 TO 40 : PRINT "@" ; : NEXT
    : FOR I = 2 TO 14 : VTAB I : HTAB 1 : PRINT
    "@" ; : HTAB 40 : PRINT "@" ; : NEXT : NORMAL
    : VTAB 3 : HTAB 7 : PRINT
  "EGBERT^COMMUNICATIONS^DISK" : PRINT
SAVE HELLO
```

28) Modify the MAIN program

```
LOAD MAIN
8010 VTAB 3 : HTAB 7 : PRINT
    "EGBERT^COMMUNICATIONS^DISK" : VTAB 5 :
    HTAB 16 : PRINT "MAIN^MENU" : RETURN
SAVE MAIN
```

29) Modify the RTTY program

```
LOAD RTTY
3 B$ = CHR$ (4 ) : GOSUB 91 : VTAB 16 : HTAB 11 :
    FLASH : PRINT "LOADING^PROGRAMS" :
    NORMAL :D$ = CHR$ (219 ) :E$ = CHR$ (221 ) :
    PRINT B$; "BLOAD^COMBO^1^8^83, D1" : PRINT
    B$; "BLOAD^SPL, D1"
79 TEXT : HOME : PRINT "BYE!" : PRINT CHR$ (7 ) :
    END
85 ONERR GOTO 73
SAVE RTTY
```

30) Modify the ECW program

```
LOAD ECW
30 POKE 115 ,0 : POKE 116 ,147 : POKE 111 ,0 : POKE
    112 ,147
110 REM
120 REM
200 REM
SAVE ECW
```

31) Modify the XFER program

```
LOAD XFER
135 REM
137 REM
SAVE XFER
```

32) Modify the TRANSFER] program

```
LOAD TRANSFER]
675 REM
1035 REM
2011 REM
2020 REM
2030 REM
2040 REM
2050 REM
2060 REM
2070 REM
2080 REM
SAVE TRANSFER]
```

33) Modify the BUFFER/MESSAGE program

```
LOAD BUFFER/MESSAGE
145 REM
150 REM
220 VTAB 23 : PRINT "THIS WILL TAKE ABOUT 30
    SECONDS" : VTAB 17
```

225 REM
SAVE BUFFER/MESSAGE

34) Modify the COMBO 1-8-83 program

BLOAD COMBO 1-8-83

This program checks for the non-standard patch to the CATALOG command on the locked disk. It checks for a $60 in the DOS. If it is there, the program continues. If it isn't there, the RTTY program bombs. The normal DOS 3.3 value is a $20. To enable it to work perfectly with DOS 3.3, one change is required which makes the check routine look for the normal DOS 3.3 value of $20 instead of the $60. (Incidentally, the $60 of the non-standard DOS disables the CATALOG command; it causes the command CATALOG to be ignored). The change is as follows:

CALL -151
54BC:20
BSAVE COMBO 1-8-83, A$5000, L$0AD5

35) Fix the same CATALOG patch in the RCV program

BLOAD RCV
4302:20
BSAVE RCV, A$4000, L$58B

36) Fix the CATALOG patch in the XMT program

BLOAD XMT
52C2:20
BSAVE XMT, A$5000, L$3E8

37) Delete the image of DOS 3.3 on the disk

DELETE DOS 3.3

38) Delete the DOS mover from the disk

DELETE DOS MOVE 3.3

You now have a fully functional DOS 3.3 version of the entire EGBERT RTTY/CW/TRANSFER system to customize at your discretion.

For starters, here is how to obliterate the serial number of the diskette.

LOAD RTTY

```
91 HOME : INVERSE : FOR I = 1 TO 40 : VTAB 1 :
    PRINT "@" CHR$ (8 ); : VTAB 7 : PRINT "@" ; :
    NEXT : FOR I = 2 TO 6 : VTAB I : HTAB 1 :
    PRINT "@" ; : HTAB 40 : PRINT "@" : NEXT :
    NORMAL : VTAB 3 : HTAB 9 : PRINT
    "EGBERT^II^RTTY^PROGRAM" : HTAB 9 : PRINT
    "WRITTEN^BY^G.W.^EGBERT" : HTAB 14 : POKE
    34 ,7 : RETURN
```

The following are immediate execution commands.

```
F2 = PEEK (175) + PEEK (176) * 256 - 8
FOR A = 1 TO 4 : POKE F2+A, 0 : NEXT
SAVE RTTY
```

Again in immediate execution mode type

```
LOAD ECW
260 REM
370 REM
F2 = PEEK (175) + PEEK (176) * 256 - 8
FOR A = 1 TO 4 : POKE F2 + A, 0 : NEXT
SAVE ECW
```

Then continue into the monitor

```
CALL -151
BLOAD COMBO 1-8-83
50D2:FF
50D3<50D2.50E8M
BSAVE COMBO 1-8-83, A$5000, L$AD5
```

And the next

```
BLOAD RCV
414E:00
414F<414E.415BM
415C:FF FF
BSAVE RCV,A$4000,L$58B
```

And that's all there is to it.

To aid you in you customizing, here is a list of programs with brief descriptions. Have fun!

HELLO: Boot-up title.
MAIN: Main menu. Uses PRINT SET, BUFFER/MESSAGE, MESSAGE.OBJ, CODE, RTTY, ECW, XFER files
RTTY: RTTY program body, uses COMBO 1-8-83, SPL files.
COMBO 1-8-83: RTTY machine language portion
SPL: Printer spooler machine language portion.
PRINT SET: Printer set-up program. Uses SPL.

ECW: CW program body. Uses XMT, RCV, SPL, GP files.
XMT: CW transmit machine language portion.
RCV: CW receive machine language portion.
GP: CW game paddle overlay in machine language.
CODE: Contains the number of programs on the disk.
XFER: Transfer title and set-up program.
TRANSFER: TRANSFER program body. Uses XFER 3800.
XFER 3800: TRANSFER machine language portion.
BUFFER/MESSAGE: Buffer/message program. Creates messages, prints the buffer; uses MESSAGES, MESSAGE.OBJ files.
MESSAGE: Message program. Not copy-protected on original disk. Uses MESSAGE.OBJ file.
MESSAGE.OBJ: Contains the canned messages and saved files. Not locked on the original disk.
DOS 3.3: Overlay of standard DOS 3.3
DOS MOVE 3.3: Relocates DOS 3.3 and overwrites the Egbert DOS with standard DOS 3.3

►Getting On The Right Track

By Robert Linden

Requirements:
Apple][+ or compatible
Apple type disk drive
Bit copier, sector editor or other program that seeks specific tracks on demand
STABILO fine-point pen, or other similar marker

When making backups of copy-protected programs, there will be times when the backup will not boot. It might keep rebooting continuously, spin with no head movement, stop, or do something else it shouldn't. Often this is the result of just a few tracks being incorrectly backed-up. Finding these tracks quickly will speed up your task greatly. Here's how:

Turn off your computer. Remove the screws holding the cover on your disk drive (*Warning: This will void your warranty*) and slide the cover to the rear and off the drive.

Turn on your computer and boot a program that seeks specific tracks on demand. Now you will need to find both the frame that holds the read/write head and the cam that drives this frame (See Figure 1).

Have the drive seek track 0, then track 22 (hex) while you are viewing the interior of the drive from one side. The object moving rapidly over (and under) the disk is the frame that holds the read/write head. Below this frame you will see a three-to-four-inch round object which turns only when the frame moves. This is the cam that drives the frame holding the read/write head.

A common method of indicating tracks for future use is to place a reference mark on the read/write frame and then, as the drive is stepped through the tracks by the track-seeking program, to mark each track on a nearby, motionless part of the drive.

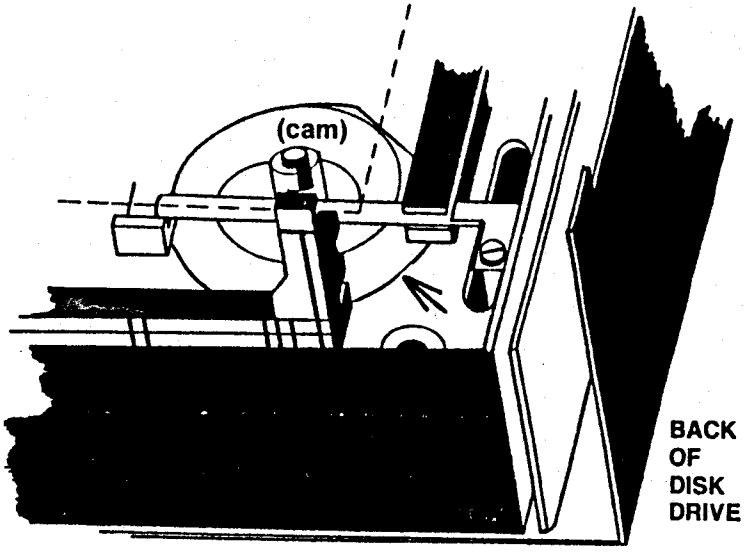
The problem with this method is that the marks are as close together as the tracks on the disk. To greatly increase the distance between the track marks I prefer marking the cam instead.

If your cam is made of shiny plastic you will need a fiber-tip pen intended for writing on plastic, such as a STABILO fine-point. If your cam is made of rough plastic, similar to Bakelite, you could use paint for greater visibility. In this case, use a water-based, model paint to avoid any risk of the paint dissolving part of the cam. Use a fine-tipped brush and, if you like, several different colors for ease in identifying the tracks. Whichever method you use, make a test mark on the cam to be sure the marks will adhere.

The Book Of Softkeys vol. 1

We have recently become aware of a figure omission in paragraph 3 of 'Getting On The Right Track' by Robert Linden (page 99).

Figure 1



The editorial staff of SoftKey Publishing would like to extend our apologies. We sincerely regret any inconvenience this omission may have caused you.

First, place a reference mark on the most easily visible spot that is directly next to the cam.

Then have the drive seek track 0 and place a mark on the vertical edge of the cam. Make sure this mark lines up with the reference mark.

If you feel uneasy about touching the interior of the drive while it's on, or if you're not sure about what you can and can't touch, you should turn off the computer after seeking a track and then turn it on again after you have finished the marking for that track.

Next, have the drive seek track 18 (hex). On my drive this will turn the cam one complete revolution to the mark made for track 0. If your drive is different, find the track that does line up to the mark for track 0. On top of the cam above the mark write a small 0/18. Do NOT place any marks in the spiral groove that is engraved on top of the cam. This groove is used by the cam to move the read/write head, so take care not to gum it up.

Note where the read/write frame is in relation to the center of the cam. Now have the drive seek track 0 again. You will notice that the read/write frame has moved much closer to the edge of the cam. This is how you can tell if the drive is on track 0 or track 18.

Now work your way around the cam, seeking each track, marking it and labeling it, until you get to track 22. I label each track in hex (i.e. base 16) instead of base 10 since most references to the tracks are in hex. Note that the marks for tracks 18-22 (hex) will overlap with the marks for tracks 0-10 (hex). In the case where two tracks use the same marks you must take note of the read/write head frame in relation to the cam in order to distinguish which track is being accessed.

Boot the disk to be backed-up while you watch the cam to see if the drive seeks any ½ tracks or anything past track 22. Using this information, try to make a backup. If the backup will not boot properly, watch the tracks over which the drive goes before the backup fails. These are the tracks which have one or more bad sectors on them. If the drive stops or spins continuously on one track, re-do that one track. If the drive seeks the same tracks over and over again, when it did not do that on the original disk, then re-do those tracks. Good luck!

►Hard Hat Mack

Electronic Arts

Requirements:
Apple][Plus or compatible
Hard Hat Mack disk
Blank initialized disk with no "HELLO" program
Some knowledge of boot code tracing or machine language

By Rich Lyon

Hard Hat Mack is an addictive construction-site game with three different levels. I was first introduced to it at the local computer store and couldn't stop playing it. While there, I took some time to examine the boot code on the game disk and found it to have a very strange boot code, one like I had never seen before. About a month later I decided to buy the disk for, mainly, two reasons: I liked the game, and I wanted to face the challenge of breaking the copy-protection scheme.

For those of you who are not familiar with the boot process, here is a general explanation. When any disk is booted on the Apple, control is transferred to the boot program which is at $C600. If your disk controller card is in slot 5, the program will be found at $C500. It will be assumed that the card is in slot 6 to keep things simple. When executed, this program will read in track 0, sector 0 from the disk and put it in at $800. It will, then, jump to $801.

Depending on the disk, from this point another boot stage will be loaded in and, eventually, the main program will be read into memory and executed.

When it comes to copy-protected disks, almost every disk is different. The unique thing about Hard Hat Mack is that the first boot stage loaded in takes 16 pages of memory. In most cases, boot 1 only occupies one page of memory. The advantage of this lengthy boot stage is that this is the only boot stage. From here on, the game is loaded right in.

Blue-Collar Boot Code Tracing

Here are the steps used to boot code trace Hard Hat Mack:

1) Enter the Apple's monitor

CALL -151

2) Memory move the boot program down to a page in RAM so it can be modified to load in the next boot stage

9600<C600.C6FFM

3) Change the JMP $801 to a JMP $B047

96F9:47 B0

Why jump to $B047? After tracing the code for the first time, I ended up jumping there upon exiting the first boot stage. From there on I jumped to $B047 immediately.

4) Put a short routine at $B047 to shut off the drive motor and return to the monitor. A JMP $FF59 will jump to the monitor

B047:8D E8 C0 4C 59 FF

5) Insert the original Hard Hat Mack disk and type

9600G

This will execute the first boot stage to load the next boot stage into $800. This will take about five seconds because it has to load in 16 pages of memory. Usually, this boot stage occupies only one page of memory but, if you check the value at $800, you will find a $10 (16 decimal) where normally you would find a $1. This number tells the first boot stage how many sectors to read in.

6) Memory move pages $8 through $18 to $B000.

B000<800.1800M

If you list through the boot stage at $800 (801L) you will find that all it does is the memory move and then jumps to $B047.

Now, rather than modify the code at page $8, it is easier to put it where it belongs and jump directly there from boot number 1. The next step is finding the jump to the start of the program. In other words, a JMP instruction to somewhere other than within the boot stage.

The only jumps I found were two indirect ones to $42. At first I thought these were used (at least one of them) to jump to the start of the program. I traced them and found that they were not used to exit the boot. That left me knowing that I was faced with a problem.

Somewhere within this lengthy boot stage is a hidden or a coded jump. Rather than trace through everything that looked suspicious, I decided to try for a one-in-a-million shot.

I had traced the boot code about ten times prior to this and remembered one place where I had halted the boot code and most of the program had been loaded in. I went over it again and stopped in that place. Then I paged through memory and looked for something that might be the start of the game. It didn't take much looking because I found something interesting

right at $800. Without even testing it, I assumed that it was the start of the program.

Now, my next step was to boot code trace the disk again and halt it in the same place. But instead of coming to a complete stop, I would have to call a short routine to cover up the first three bytes at $800 with a 4C 59 FF. That way, if the boot code jumped to $800, the start of the program would cause a jump into the monitor.

Once everything was set, I executed the boot and waited with high hopes. Just as the game was about to start, I heard a beep and the cursor appeared. Indeed, $800 was the start of the game. The place I interrupted the boot stage was at $BBC4 and at that location was a JMP $BBD4. What I did there was to set $BBC4 to jump to $B100 and at $B100 I put the routine to cover up the start of the program with a JMP $FF59. $B100 is a safe place to put data because it is only the data for the Electronic Arts logo.

7) Set a jump to $B100 at $BBC4

BBC4:4C 00 B1

8) Enter the routine to cover up the start of the program

B100:A9 4C 8D 00 08 A9 59 8D
B108:01 08 A9 FF 8D 02 08 4C
B110:D4 BB

9) Reboot the disk

9600G

This will load in the entire game and return control to you. When the prompt appears you are ready for the last step before saving the game. Right now we want to restore what was originally at $800 before the routine at $B100 covered it up. It was a JSR $2204.

10) Restore the code that was at $800

800:20 04 22

Next, we will reboot DOS. First, we must move page $8 to a safe place or it will be overwritten when we reboot. The question is where to put it.

Paging through memory, I found an area that looked like it contained "garbage." Actually, I concluded that all memory from $3400 to $3FFF was unused because the game did nothing with it before clearing the hi-res page.

11) Memory move page $8 to page $34

3400<800.8FFM

12) Put in a blank slave disk with no "HELLO" program and type

6P

13) Now, after booting DOS, enter the monitor again

CALL -151

14) Next, we will move page $8 back to its proper place from page $34

800<3400.34FFM

The game could be saved now but it would not work.

When the space bar is pressed to begin the game, a check is done to the disk to make sure that the Hard Hat Mack disk is present. The only problem is in finding where the disk is accessed. nowing that this happens when the space bar is pressed, when you do that, look for a read from the keyboard and a check. I found this in the subroutine at $BC8. There was also an LDA $C000 and, further on, a CMP #$A0. When the space bar is pressed, this subroutine sets a flag byte and returns.

The next step is to find out where the subroutine at $BC8 is called from. I found this at $84E. After calling the subroutine it checks the flag and, if it is set, continues.

At $864 is a JSR $4D34. This is part of the game beginning sequence. The subroutine at $4D34 does a lot of playing with the stack. By tracing the PLAs and PHAs, I found that it leaves two extra values on the stack and then does an RTS. This is a disguised jump. Confused? When an RTS is executed, the two top values are taken off the stack and the computer jumps to the address of those two values, plus one. When I checked the two values left on the stack, I found $FF and $04. Adding one to $04FF you get $0500 and that's where it was going.

The next text page is $0500 and there was nothing there upon exiting the boot. At $803 there is a JSR $3300 and if you list through $3300 you will see that it moves $3000 through $32FF down to $500 so when you list through $3000 you are actually seeing what will be at $0500.

Looking at $3000 there are disk access commands in the assembly. Therefore, you can assume that this is where the disk is checked. All that we have to do to remove this disk check is to change the subroutine at $4D34 so it does not push two extra values on the stack. Simply change the PHA at $4D53 to a PLA so that instead of pushing on the second value it would pull off the first, hence, leaving the stack the same.

15) Change the operation at $4D34 from PHA to PLA

4D53:68

All we have to do now is save the game to disk. Since DOS does not allow us to save a file longer than $7FFF bytes and we need to save $8D00, we have to change a byte in DOS.
16) Patch DOS so that we can save this long a file

A964:FF

17) Finally save the BRUNable version of Hard Hat Mack

BSAVE HARD HAT MACK,A$800,L$8D00

This will save all memory from $800 to $94FF. Actually, the game loads in past $9500 but, after testing the game, I found it to work fine. All the memory above $9500 is just "garbage" memory.

Finally, if you wish to compress the file remember that pages $34 to $3F are free. This will save you 12 sectors on your disk. I often shorten game files as much as possible.

(Warning: This article is intended for advanced users who are familiar with the internal hardware of the Apple. SoftKey Publishing is not responsible for any damage done to the computer while following the outlined procedure.)

►Hidden Locations Revealed

By Enrique Gamez

Requirements:
Apple][or][+ only (will not work with the //e)
Disk Organizer II by Sensible Software
Small-gauge insulated wire (no. 24)
16-pin DIP socket

We've been taking for granted that it's possible to break into any program by just switching to the old monitor F8 ROM and hitting reset. However, with Disk Organizer II, this causes a carriage return and the text page to scroll, thus losing any information placed on the first line of text page 1. This information is vital when trying to perform a softkey.

To solve the scrolling problem I discovered a previously inaccessible set of locations for the first line on the text page. My technique involves gaining control over the screen soft switches that display text page 1. Preventing it from scrolling and allowing recovery of the needed information from the first line. I'm sure this technique is used by many other programs, so read on even if you don't own Disk Organizer II.

Hidden Addresses

I first noticed some indirect references in the assembly code to locations $400-426. The makers of Disk Organizer II tried to conceal jump addresses by storing them in the plowable first line of the text page. These crucial entry points are for the routines which perform the delete, rename, exhume, move, purge and change boot tasks.

In following this procedure you'll force the Apple to display the text page, no matter what the program in memory would like to do. You'll learn a little about soft switches on the way and, most importantly, how to gain control over them.

Technical Background

Having a memory-mapped screen is very convenient; writing to any position on any screen becomes as simple as POKEing a value or STAing a specific byte. However, not so convenient is the experience of having some locations self-modify as you're

trying to read them. Have you ever done a hexdump of the $400 to $7FF area while viewing the text page? Total nonsense.

The screen soft switches are what allow you a "window" into the Apple. By flipping a switch here and there you can literally browse through memory (without changing anything there).

Screen Switching Demo

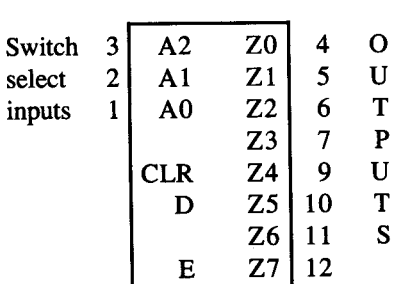
Type the following *"Screen Switching Demo"* and watch what happens. If you goof up, just turn off the computer, reboot, and start over. Though you may lose sight of what you're typing, keep going. You'll just need to be a more careful typist.

Type this	Explanation	View window
CALL -151	Enter monitor	$400-7FF
C054:0	Select page 1. Nothing happens.	
C053:0	Select mixed screen. Nothing happens.	
C051:0	Select text screen.	
C050:0	Select Lo-res graphics, mixed.	
C052:0	Select full screen graphics.	
C051:0	Back to text.	
C055:0	Select text page 2. What a mess.	$800-BFF
C050:0	Select Lo-res graphics page 2.	
C053:0	Select mixed text and graphics page 2	
C052:0	Select full screen	
C057:0	Select Hi-res page 2.	$4000-5FFF
C054:0	Select Hi-res page 1	$2000-2FFF
C053:0	Select mixed text and graphics page 1	$2000-2FFF, $400-7FF
C055:0	Select mixed text and graphics page 2	$4000-5FFF, $800-BFF

What controls and decodes these little switches you've just been throwing is the IC F14 chip (labeled SN74259N). Each switch controls a different aspect of what is placed on the screen. That's why a certain byte can show up as a flashing character if in the text mode, as colored blocks if the lo-res graphics switch has been thrown, or even as a series of dots if $C057 is accessed.

To the right is a diagram of the chip in question.

The integrated circuit (IC) gets its power through the two pins not shown; 8 and 16. By convention, in a 16-pin package the +5V (Vcc) connection goes to pin 16 ("HI"). Pin 8 is 0V, or ground ("LO").



SN74LS259 (F14)

Notice the half-moon notch in Figure 2. It should point toward the keyboard.

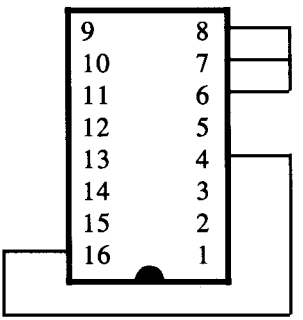
One nice thing about working with logic circuits at such low voltages (0-5 volts) is that you can force certain lines low or high without any damage to the ICs, if you're careful.

NOTE: VERY IMPORTANT. Don't connect pin 8 to pin 16. That would short out the power supply.

As you may have noticed from following the screen-switching demo, you need to throw two or three switches to get to a certain point. With the chip disconnected, there's no circuitry to hold the switches "in position" so to speak, so you'll have to physically wire some pins HI and some LO. Needless to say, it could get rather hairy.

Because of this, I've figured out the correct combination for this application and soldered a jumper-socket (see figure 2) that I can quickly plug in to check if a particular program tries to use this protection technique. Disk Organizer II does.

Figure 2



This chart shows the results of the author's own experiments with the switch outputs.

(+) = HI (−) = LO (0) = OPEN, no connection								
4	5	6	7	9	10	11	12	Effect
+	0	−	0	0	0	0	0	Text page 1
+	0	0	0	0	0	0	0	Text page 2
0	−	−	−	0	0	0	0	Lo-res page 1
0	−	0	−	0	0	0	0	Lo-res page 2
0	0	−	−	0	0	0	0	Mixed text & Lo-res page 1
0	0	0	−	0	0	0	0	Mixed text & Lo-res page 2
0	−	−	0	0	0	0	0	Hi-res page 1
0	−	0	0	0	0	0	0	Hi-res page 2
0	0	−	0	0	0	0	0	Mixed text & Hi-res page 1
0	0	0	0	0	0	0	0	Mixed text & Hi-res page 2

Controlling The Soft Switches

1) Turn off the computer.

2) Carefully remove IC F14. (Remember: Without this decoder chip, any page flipping signals sent by the program (or ROM) to pins 1, 2, and 3 have no physical connection with the output pins 4-7 and 9-12. Therefore, you are free to throw your own.)

3) You may now turn on the computer and carefully experiment with pins 4-7 and 9-12, connecting some HI (to pin 16) or LO (to pin 8). Watch the results on your screen. When you want to continue, plug in an IC socket that has been wired as shown in Figure 2. Be sure it is oriented via the tab cutout toward the keyboard.

4) Once installed, boot the program in the usual way. Now convert the various screen characters back into hex code using a chart like the one in Hardcore Computing Update 2.1 (old series) or most Apple manuals. These jumpers will show you the hidden information you've been missing.

Epilogue

Just when you think you've got it beat, you always bump into another scheme, and this one has me stumped. Disk Organizer II has also cleverly hidden an important byte at $200. This is the first location in the input buffer, which is snuffed as soon as a key is typed. Any ideas?

Bibliography

Apple Computer, Inc. *Reference Manual,* part #A2L0001A, pp. 12-14, 79, 98-99 and schematic.

Lancaster, Don, *Enhancing Your Apple][,* Indiana: Howard W. Sams & Co., Inc., 1982, p. 83.

Luebbert, William F., *What's Where in the Apple,* Massachusetts: MicroInk, Inc., 1981.

Signetics Corp., *Signetics Logic IC Data Manual.*

►Home Accountant

Continental Software

Requirements:
Home Accountant disk
One initialized disk
Apple's FID program

By Barry May

For many months the Home Accountant has consistently ranked #1 on Softalk's Home Top 10 list. This popular checkbook/home budget program has some very nice features, but it has some very annoying ones as well. Its three biggest faults are:

1) You cannot go back to a previous month to make an addition or correction;
2) You must wait an inordinately long time for the copyright notice and logo display to run through before you are presented with the opening menu, and
3) The program is constantly loading new modules and re-reading the data files resulting in very long waits between tasks.

Removing the copy protection allows at least two of the problems to be solved easily. The opening can be eliminated with a couple of simple changes (as shown below) and a fast DOS will speed up the disk I/O.

The protection on the Home Accountant is very simple. The address epilog has been changed from DE AA EB to DF AA EB. All that needs to be done is to change the read address routine to ignore the first byte of the epilog. This is done by changing byte $B993 (47507 in decimal) from an $AE to a $00. Now, instead of branching to the "Bad Read" routine, the computer merely branches to the next instruction, the one it would normally execute if everything was OK.

All that is left to do is to get the programs off the protected disk and onto one of yours. The easiest way to do this is to run a program that copies files using the DOS in the computer, like FID. Just copy the programs on the disk like you would if you were backing up programs from a normal disk.

1) Boot a System Master disk.
2) Change the branch

POKE 47507,0

3) Run the copy program

BRUN FID

Copy all the programs from the Home Accountant to an initialized disk. (Use a disk initialized with a fast DOS, if you want) and that's it!

After releasing the program from its protection, deleting lines 200 through 1110 from "Hello" and using Beagle Brothers' Pronto DOS, the time from start to menu drops from 37.7 seconds to 13.7 seconds. A fast DOS which speeds up textfiles (Diversi-DOS does this) will help even more.

Now it's up to someone else to write a routine for correcting previous months on the program.

►Homeworld

Sierra On-Line, Inc.

Requirements:
Apple][48K
One blank disk
CopyA from DOS master disk
Disk edit program

By Marco Hunter

Here is a quick softkey.

1) Copy with COPYA.
2) Edit track 10, sector 0A and change byte 09 from 49 to EA and byte 0A from C9 to 60.

That's it.

►Lancaster

Silicon Valley Systems

Requirements:
48K Apple, with Applesoft
One disk drive and DOS 3.3
DOS 3.3 System Master
Lancaster
One blank disk

By Clay Harrell

Lancaster caught my eye as having unusually smooth animation and graphics. Being intrigued by the animation and playability of the game, I bought it with the intention of discovering the author's methods of animation. But, in order to snoop through the code, it meant that I had to unprotect it first for disassembly.

The first thing to notice upon booting the game is that an Applesoft cursor appears at the bottom left of the screen. This means that the protection involves somewhat of a normal DOS and disk structure. Some protectors have begun to bypass the routine which outputs the prompt, but you can still guess that there's a modified DOS present if the boot sounds like a normal DOS boot, but the disk won't copy with COPYA.

To confirm my hunch that Lancaster was using a modified DOS, I booted one of my normal DOS 3.3 disks and put Lancaster in the drive and typed CATALOG. The disk drive recalibrated and made other obnoxious noises and returned the message I/O ERROR. Not that I was expecting any miracles, but why not try?

I still believed there was a somewhat normal DOS present on the disk, however, more snooping had to be done. Let's think about what causes an I/O error, for a moment.

Whenever anything goes wrong during disk access, RWTS branches to a routine at $B942 to set the carry bit and return. The other routines in RWTS monitor the carry bit and check to see if there was a bad data read, a bad address read or some other no-no.

At $B942 there are simply two instructions: SET THE CARRY and RETURN. If we wish to defeat the DOS error checking (which we do in this case), we can change the SET THE CARRY to CLEAR THE CARRY. By making this change, you are telling RWTS not to check for any errors, assume everything is alright and go on.

Obviously, this is not good general practice since you are defeating the purpose of all the careful error checking that DOS does. But it is great for examining a modified DOS. It will

handle any changes to the epilog bytes or intentional errors in the checksum of either field, but not in the header bytes (header changes must be done by modifying the appropriate code in the subroutine).

With this in mind, we enter the monitor with CALL -151 and type B942:18 to disable the DOS error checking. Now type CATALOG and, gosh! Indeed, there is a catalog!

Now all the files are loadable (or BLOADABLE) for further snooping. But this is not the end of the protection.

Examining the HELLO program revealed an unusual file named SVS and some curious CALLs and POKEs. Upon further inspection, I came to the conclusion that the file SVS was a secondary protection involved in Lancaster. Simply preventing the loading of this file and disabling the calls to its routines was all that was really needed in the deprotection of Lancaster.

The following steps recap the procedures necessary in the deprotection of Lancaster:

1) Boot a normal DOS 3.3 disk and initialize a blank disk with the command

INIT HELLO

2) Type

CALL -151

to enter the monitor and then

B942:18

to disable the DOS error checking routine.
3) Insert your DOS 3.3 System Master in a drive and run the program FID with the command

BRUN FID

4) Copy all the files from the Lancaster disk to the blank initialized disk you just prepared.
5) Boot your DOS 3.3 System Master and put your newly created Lancaster disk in a drive.
6) Delete the Hello program from your Lancaster clone disk

DELETE HELLO

7) Unlock the file Lancaster with the command

UNLOCK LANCASTER

8) Rename the file Lancaster to Hello with the command

RENAME LANCASTER,HELLO

Lancaster is now unprotected and all the code can be examined for educational and modification purposes.

►Magic Window II

ARTSCI, Inc.

Requirements:
Apple][with 48K
One disk drive
One initialized blank disk

By Bobby

Magic Window II is an updated version of the old Magic Window word processor. Many new features have been added including paragraph gluing and search and replace functions. Unfortunately, a few bugs have also crept into the program and, in an effort to fix these bugs, I had to unlock the disk. Although the original program disk can be catalogued and files can be loaded and saved to it, the actual word processor is protected and does not appear on the disk catalog.

I discovered that there are four separate Magic Window programs stored as consecutive sectors of data. The four versions are:

1) 40/80 (columns) without a RAM card
2) 40/80 with a RAM card
3) 40/70/80 without a RAM card
4) 40/70/80 with a RAM card

After examining the file "BRUN MW II" I was able to determine which sectors each of the four versions were on. The boot program (BRUN MW II) first checks to see if a RAM card is present, and then loads the proper version of the program (40/80 or 40/70/80 columns). Writing a BASIC program to duplicate this function was easily done, but I still needed the actual programs from the disk so that the BASIC program could load them.

The easiest way to do this was to use the same program that Magic Window II uses to read in each of the four files (BRUN MW II). What follows is a step-by-step procedure for getting the proper routine into the computer.

The Hello Program

1) Boot the DOS 3.3 System Master

   PR#6

2) Remove the Master disk and insert a blank diskette.
3) Clear the program in memory.

   FP

4) Enter the Applesoft Hello program in Listing 1.
5) Initialize the disk with the program HELLO

INIT HELLO

6) Remove this disk. This will be your new Magic Window diskette.

Now we are going to load each of the four versions of Magic Window from the old Magic Window disk and save them onto the new disk. Place a write-protect tab on the original so you don't accidentally alter the disk.

Copying The Disk

7) Boot the original Magic Window II disk. When the prompt appears (asking which version to load), press RESET. This bypasses all of the protection on the disk and loads in the main controller routine intact.
8) Now enter the monitor

CALL -151

(If you get a "OUT OF MEMORY" error, repeat step 8.)

Since there are four versions of the program on disk, each of these must be loaded and saved separately.
9) Type

18:04 00 3A 0A
80F6G

This information tells the subroutine on which track and sector to start, the number of pages to read, and where to place the data.
10) After the disk stops spinning, place the blank disk in the drive and save the file (remember to do this from the monitor)

BSAVE MW II 1, A$A00, L$3A00

The other three files should be saved in the same manner. Don't forget to put the blank disk back in the drive before saving each file.
11) Insert original disk and load the next file

18:12 00 5A 0A
80F6G

12) Insert backup disk and save

BSAVE MW II 2, A$A00, L$5A00

13) Insert original disk

18:08 00 3B 09
80F6G

14) Insert backup disk

BSAVE MW II 1/WITH RAM, A$900, L$3B00

15) Insert original disk

18:0C 00 3B 09
80F6G

16) Insert backup disk

BSAVE MW II 2/WITH RAM, A$900, L$3B00

17) The file SYS.OPTIONS can now be loaded from the Magic Window disk and placed on the backup. First, insert the original disk and

BLOAD SYS.OPTIONS

18) Next, insert the backup disk

BSAVE SYS.OPTIONS, AABD, LD

The other Magic Window disk can be copied with COPYA from the System Master onto a blank disk.

Modifications To The Hello Program

The HELLO program allows you to select which version of Magic Window you wish to use. The program first POKEs a small machine language routine into page 3 of memory. This routine checks for a RAM card and sets certain flags depending on whether or not one was found. After this is completed you will be presented with two choices exactly like those you saw on the Magic Window II disk. The BASIC program operates in a manner similar to the original machine language program that was found on that disk.

Since each of the four files can stand alone, the HELLO program can be bypassed and the correct version of Magic Window can be BRUN directly. A program allowing you to ignore the first question and immediately skip to the proper version would consist of only one line:

```
10 PRINT CHR$(4) "BRUN version of Magic Window"
```

The following chart will allow you to choose the proper version to run:

	40/80	40/70/80
With RAM	MW2 1/WITH RAM	MW2 2/WITH RAM
Without RAM	MW2 1	MW2 2

The Technique

The unlocking technique for Magic Window II can be used with some other software on the market. ARTSCI only protected two of the sectors on the Magic Window II disk which contained part of the loader required to load the main Magic Window menu. I simply traced the file BRUN MW II to see what it did and what other sectors it loaded into memory. The four Magic Window files could then be loaded by calling a routine that started on a given track/sector and loaded the proper number of sectors into memory, placing them at a given location. By following the previous set of directions, you told the Magic Window menu where each file was by changing locations 18, 19, 1A and 1B:

18: First track of data
19: First sector of data (always 00)
1A: Number of sectors to load
1B: The high byte of the buffer (low byte is always 00)

HELLO program listing

```
10 D$ = CHR$ (4 )
20 NORMAL : TEXT : HOME
30 PRINT "MAGIC WINDOW II"
40 PRINT : PRINT
50 PRINT "PLEASE SELECT VERSION:"
60 PRINT
70 PRINT "1 - 40/80 COLUMN (MORE FREE SPACE)"
80 PRINT
90 PRINT "2 - 40/70/80 COLUMS (LESS FREE SPACE)"
100 PRINT : PRINT
110 PRINT "YOUR SELECTION? " ; : GET A$
120 PRINT A$
130 A = VAL (A$ ) : IF A < 1 OR A > 2 THEN PRINT CHR$ (7 ) : VTAB 11 : GOTO 110
140 A$ = "" : GOSUB 180 : CALL 768 : IF PEEK (0 ) THEN A$ = "/WITH RAM"
150 HOME : VTAB 12 : HTAB 10
160 PRINT "LOADING MW II " A;A$
170 PRINT D$ "BRUN MW II " A;A$ : END
180 FOR X = 0 TO 29 : READ B : POKE 768 + X ,B : NEXT
190 RETURN
200 DATA 160,0,132,0,173,131,192,173,131,192,152,141,
    0,208,205,0,208,208,7,200,208,244,169,1,133,0,173,129,192,96
```

►Multiplan

Microsoft Corp.

Requirements:
Apple][48K
DOS 3.3 Master disk
COPYA (from Master disk)
A disk edit program

By Bobby

Multiplan is an excellent spreadsheet program by Microsoft. It includes an unusually complete manual with a reference guide, and an auto-help mode from within the program. Multiplan allows one and only one backup to be made, which I found to be an insufficient guarantee of non-loss of data (three is my minimum backup policy for commercial software).

The Protection

The program is only protected on tracks zero through four. The protection scheme is to change the end of address mark on those tracks from $DE to a strange value. To allow the Multiplan DOS to read the unprotected disk, a modification must be done to track $00, sector $0A. Byte $0D must be changed to hold the value of $DE.

The Deprotection

1) Boot from the DOS Master disk.

PR#6

2) Fix the check for $DE in DOS.

POKE 47507,0

3) Run COPYA and follow the prompts to copy the Multiplan disk.

RUN COPYA

4) Use your disk edit program to change byte $0D on track $00, sector $0A from whatever it is to $DE.

The copy of Multiplan can now be duplicated with COPYA, or any number of other copy programs. Enjoy!

NOTE: The copy disk option (1) on the utility menu will make copies of this disk.

►Pest Patrol

Sierra On-Line Inc.

Requirements:
Apple][with 48K
Pest Patrol disk
One initialized slave disk with HELLO program deleted
One disk drive
Some knowledge of machine language

By Ray Darrah

Pest Patrol is an outerspace shooting gallery with many diverse levels, each employing its own enemy attack patterns. Built-in options help configure the game to the player's machine and ability level. For example, Pest Patrol may be played with the keyboard, paddles, rheostatic joystick, or Atari joystick. Although each game is somewhat different, they are all fun.

Unfortunately, the protection scheme used on Pest Patrol is such that it will continually reboot on a computer with a language card. That just about washes out all the Apple //e and Franklin Ace users.

Never fear, for Hardcore COMPUTIST has a solution to both the backup problem and the language card problem: convert Pest Patrol into a normal binary file. This will omit the booting sequence where the check for the language card resides (and the reboot subroutine). Once this is done, Pest Patrol will work on an Apple //e or Franklin Ace just as if the computer was an Apple][without a language card.

Where To Begin?

The first step I took in breaking Pest Patrol was to check for simple prologue or epilogue alterations. If these alterations were the problem, I easily could have made a softkey to do the job of backup and my problem would have been solved (although the program still wouldn't run on a computer with a language card). But there were no alterations.

I noticed that the data on this disk was unlike normal data stored by DOS, so I decided to boot code trace the program.

Boot Code Tracing: The Concept

To boot a disk, the computer must be able to load track 0, sector 0. This is where the first in a sequence of programs responsible for loading the main program into memory is written.

The boot code trace disk-breaking method depends on the fact that track 0, sector 0 must always be loaded for any disk to boot. It works by tracing the steps which the computer follows during the entire process of booting a disk. First a small program in the disk controller card loads a 256-byte program stored on the disk's track 0, sector 0. This program is loaded into memory beginning at $0800 and is responsible for loading the next program in the boot process. There may be several of these boot programs (each usually longer than the one before it) leading up to the actual loading of the main program stored on the disk. While tracing, this process is halted to examine each program before executing.

The second short program (on track 0, sector 0 of the Pest Patrol disk) immediately loads a third, larger program into memory. This third program checks for a language card and, if none is present, loads the main part of the game program. If a language card is discovered, the computer is instructed to reboot endlessly.

How To Boot Code Trace

This article is an account of how I boot code traced Pest Patrol. Since the text follows the order of my actions, a complete list of steps for copying the disk is not found until near the conclusion. This organization will help those trying to learn boot code tracing.

Refer to the procedure listed under "The Whole Thing" for a complete set of instructions for copying Pest Patrol.

Beginning A Boot-Code Trace

I started with the usual boot tracing preliminary steps:

1) Turn on your Apple (or Apple-compatible).
2) Press RESET before the computer has a chance to boot.
3) Enter the monitor

CALL -151

4) Put zeroes in all memory locations from $0800 to $BFFF, inclusive

800:00 N 801<800.BFFFM

Placing zeroes in all RAM higher than $07FF makes it easier to discover the location in memory at which the programs load. Look for locations where the zeroes have been replaced by other code; a program has been loaded there.

5) Move the boot code from $C600 (slot 6) to $9600

9600<C600.C6F7M

Only the part of the boot code responsible for loading track 0, sector 0 into $0800 is transferred. The move command is halted just before the JMP to $0801 (contained in the controller card) by indicating location $C6F7, instead of the normal $C6FF, which would have included the JMP command. Since the memory has been zeroed, the boot process is halted by a BRK instead of a JMP at location $CF68 which occurs right after loading the sector. This results in the partial boot of Step 7.

6) Insert the Pest Patrol disk.

7) Execute the partial boot

9600G

After completing this last step of the beginning boot procedure, the computer will beep and display the message:

96FA-A=01 X=60 Y=00 P=31 S=F0

The disk drive will keep spinning. That is to be expected because the program has been halted at an early stage due to the partial boot. You must let it continue to spin while performing the boot code trace, but opening the drive door will prevent wear on the disk.

At this point, the boot process has been halted just before executing location $0801 in memory where the short boot program on track 0, sector 0 always is loaded.

Now begins the dirty work: examining the machine language code starting at $0801 ($0800 holds the total number of consecutive sectors to be read) to locate where the next stage of the boot process resides.

Searching The Machine Code

At first glance, the Pest Patrol machine code looked like a valid program. However, upon closer examination, I found many things that didn't look right. For example, statements such as these:

```
0809- 90 78      BCC $0883
080B- D0 01      BNE $080E
080D- AD 20 9C   LDA $9C20
0810- 08         PHP
0811- A0 3F      LDY #$3F
```

I noticed the LDA $9C20 followed by a PHP and thought, "Why would anyone care what was in location $9C20?" This is what I call an irrational command. Then I saw the preceding BNE which branched to the middle of the LDA command (20) rather than to the beginning (AD). This tipped me that the BNE might always be taken (skipping the first byte in this manner). Sure enough, when the code was disassembled and the confusing byte at $080D excluded, a hidden rational command was revealed at $080E.

```
0809- 90 78      BCC $0883
080B- D0 01      BNE $080E
080E- 20 9C 08   JSR $089C
0811- A0 3F      LDY #$3F
```

This made me dread looking at more code. What if I missed a hidden command? How long would it take to find them all? Well, it wasn't too long before I stumbled across this wondrous piece of machine language.

```
085E- 8C 0B AA   STY $AA0B
0861- 10 01      BPL $0864
0863- 4C 20 D8   JMP $D820
0866- B6 AD      LDX $AD,Y
0868- 08         PHP
0869- 03         ???
086A- F0 03      BEQ $086F
086C- D0 15      BNE $0883
```

The first thing I noticed was the ???. Whenever I see a ??? surrounded by what appears to be irrational code, I immediately think it could be a data table of some kind. But this one looked like it was right in the middle of rational code. Stepping backward, I saw JMP $D820. This and the two following statements certainly looked fishy. Then I found it: a "branch on result plus" (BPL) to the second byte in the jump instruction (20). This is what it looks like when the byte at $0863 is eliminated.

```
085E- 8C 0B AA   STY $AA0B
0861- 10 01      BPL $0864

0864- 20 D8 B6   JSR $B6D8
0867- AD 08 03   LDA $0308
086A- F0 03      BEQ $086F
086C- D0 15      BNE $0883
```

Once again a hidden rational command was revealed, this one at $0864. Finding these wasn't easy, but it was worth the effort.

The other byte inserted to confuse the issue was at $086E (right after the preceding example). The best way to find these hidden commands is to look at the branches and other flow-related commands in the program. Spotting these only becomes easier with practice.

There are also two 11-byte data tables starting at $0881 and $089A. Data tables are much easier to find because they are usually referenced by another part of the program. The only tricky part is trying to determine their lengths (but this isn't as tricky as you might think).

Five Subroutines

After spending quite some time scrutinizing this mad program, I concluded that it was comprised of five subroutines. The backbone of the program is the subroutine starting at $089C which loads three sectors into memory starting at $B500. Other subroutines include a translate-table builder at $0817, a routine to get one byte of data from the disk starting at $0872, and a reboot subroutine starting at $0883. This second program has a somewhat obvious exit to $B800 at $086F. The next step was to alter the program to stop just short of exiting.

Stopping Before The Exit

To make the sector safe to execute, I typed

86F:00

I shut the drive door, crossed my fingers, and typed

801G

(It was very hard to type this with my fingers crossed.) The disk made a strange noise, and the computer responded with a beep and the message:

```
0871-A=00 X=0B Y=FF P=33 S=EE
```

The boot process again was halted. I then had a very large program in memory (many of the higher addresses no longer contained zeroes) with an entry point of $B800.

This was the third boot program, which contained the language card check. The disk was still spinning, so I once again opened the drive door to prevent unnecessary wear and tear on my expensive Pest Patrol disk. Yes, more code tracing was ahead!

I knew I was getting closer to having the entire Pest Patrol program in memory because the number of hidden commands steadily increased. There were too many to list here but, if you're interested, you'll be able to find them.

Careful tracing of the program starting at $B800 revealed that it decodes a lot of memory and moves it into its proper location. It then exits at $B8A4 if you have a language card or $B8A7 if everything is okay (it also clears the text screen). From $B8A7, the program was supposed to go to $B2E0, so I placed two more breaks by typing

B8A4:00
B8A7:00

I then executed the modified program with

B800G

The screen cleared and so did my mind. I didn't feel like tracing the code starting at $B2E0, so I listed it until I found an exit. After a few screens, I found this:

```
B375- A9 B4      LDA #$B4
B377- 48         PHA
B378- A9 BD      LDA #$BD
B37A- 48         PHA
B37B- 4C 7A B4   JMP $B47A
```

It looked like the programmer who wrote Pest Patrol wished to execute a subroutine at $B47A and then intended program execution to continue at location $B4BE.

My hunch was correct. When I shut the drive door and typed the following (after some funny disk noises followed by a beep) the disk drive stopped. This is what I typed

B375:00
B2E0G

(wait for drive to stop)

B47AG

This was it. I knew that one of two things had happened. Either I had the entire Pest Patrol program in memory or things were messed up pretty badly.

I then remembered the code starting at location $B4BE. Some quick listings revealed (among the hidden statements and other sneaky stuff) that this program did a large amount of memory manipulation. After making this discovery, I found the equivalent of a JMP to location $0800 at $B466. Trace this one for yourself. It's a nightmare!

Luckily, I found no access to the disk in this subroutine which was a load off my mind. You only live once, was my only thought as I typed

B466:00
B4BEG

Once again the monitor awaited my next command. This was the big moment. Was there going to be valid code at $0800 or was there an error in my painful tracing? I typed

800L

I was amazed at the absence of hidden commands. Instead, I found a little routine to set all the vectors at the end of page 3 to $4000. This was followed by a number of STAs to consecutive locations starting at $0000. The program then JSRs to that location. This is followed by the usual strange stuff (messing around with pointers and the like).

Finally, after breaking the program in several places and examining various locations, I surmised that the main part of this program moves $0900-$8700 into $4000-$BE00. Then it jumps to location $4003. If you wish to find this out for yourself, it is best to NOP both of the STA $03F0,Y commands. Otherwise, the BRK vector, as well
as the reset vector, will be overwritten.

I observed that an 800G at this stage would start Pest Patrol. Unfortunately, once executed, I couldn't escape from it. I decided to follow my notes from the beginning to the point where I typed 800G.

The Whole Thing

Assuming the disk controller is in slot 6, the following is a brief overview of my procedure.

1) Turn on your Apple (or Apple-compatible) without a disk in the drive.
2) Hit RESET.
3) Enter the monitor

CALL -151

4) Put zeroes in all memory locations from $0800 to $BFFF, inclusive

800:00 N 801<800.BFFFM

5) Move the bootcode from $C600 (slot 6) to $9600

9600<C600.C6F7M

6) Insert the Pest Patrol disk in the drive.
7) Execute the partial boot

9600G

Don't press RESET to stop the spinning of the drive; let it turn as you complete the remainder of the procedure.

8) Type the following

86F:00
801G
B8A4:00
B8A7:00
B800G
B375:00
B2E0G
B47AG
B466:00
B4BEG

After reviewing the preceding steps, I made two modifications.

9) Type

805:A9 00 8D
808:F2 03 A9 E0 8D F3 03 49
810:A5 8D F4 03 D0 0D
8DC:4C 00 40

These modifications enable reset to stop the program (you will be without DOS). They also relieve the program of its boring title page, which lasts about 20 seconds too long. In addition, they eliminate a little routine which performed some memory verification, printing "CHECKSUM ERROR" and making an awful noise if something was wrong.

All that was left was to save this modified version. A few seconds of thought and I had it. I decided to boot with a 48K slave disk (saving page $8 first, of course) and then restore page $8 and BSAVE the file.

10) Save page $8 on page $96

9600<800.8FFM

11) Insert a 48K slave disk WITH NO HELLO PROGRAM. Make sure this is a slave disk (using a master will wipe out the code.

12) Boot the disk

C600G

13) Return to the monitor (if it doesn't work the first time, try again)

CALL -151

14) Move page 8 from page 96 back to its original location

800<9600.96FFM

15) Insert the initialized diskette on which you wish to have the Pest Patrol backup (the game uses 131 sectors, so it should be a relatively empty one).

16) BSAVE the entire program (it takes about 42 seconds)

BSAVE PEST PATROL, $800, L$7FFF

17) You now can BRUN Pest Patrol after booting normal DOS.

A Confession

To be honest with you, this was my first attempt at breaking a copy-protected disk. I found it to be much easier than I had anticipated. The entire job took me only about 15 hours. I am sure the process will take less time as I become more experienced. Well, have fun with your backup of Pest Patrol. I suggest storing the original Pest Patrol game and all of your other original disks in a dark, cool place.

►Prisoner II

Eduware

Requirements:
Apple][48K
DOS master disk
COPYA program
One blank disk

By David Kirsch

Prisoner II uses standard DOS for tracks $00-$34. The game also uses track $35, which contains special copy protection data, none of which is needed to run the program.

Here's how to get rid of the track $35 access.

Making A Copy

1) Boot from the DOS Master disk and use COPYA to copy the disk.

PR#6
RUN COPYA

2) Get rid of the track $35 check.

UNLOCK IF.SHAPE
BLOAD IF.SHAPE
CALL-151
57B4:BD 8C
BSAVE IF.SHAPE
LOCK IF.SHAPE
3D0G

That's it. You now have an unprotected backup copy.

►A Fix For RANA Drive Owners

By Joseph W. Leathlean

I have a solution for all Rana drive controller owners who wish to do Boot Code Tracing.

While the Rana controller's ROM code is incompatible with the standard ROM and controller, the I/O addresses are supposed to be compatible since they will work with DOS 3.3. So, all Rana owners have to do is to borrow some time on a computer with a standard controller and do the following:

1) Boot a diskette with normal DOS 3.3

PR#6

2) Save the code from the Apple controller card to a disk.

BSAVE CONTROL ROM, A$C600,L$100

3) When they want to do the boot code trace, instead of moving the controller ROM routine to $x600, just BLOAD the file CONTROL ROM at the address needed. They should be able to follow the boot code tracing procedures with no problem.

►Sammy Lightfoot

Sierra On-Line, Inc.

Requirements:
Apple][with 48K
One disk drive
One blank disk
Sammy Lightfoot Diskette
DOS 3.3 System Master with COPYA
Any disk editor (such as DiskEdit)

By Eric Kinney

Sammy Lightfoot is a running/jumping/climbing type of game which is fun to play, has high quality graphics, and is easy to backup as you will soon see.

The game has three "scenes" with six levels of difficulty for each scene. Sammy, the hero of the game, is trying out for a circus act in which he bounces on trampolines, dodges giant circus balls and uses ropes to swing over flames and certain death below.

The copy-protection used seems to be a check of track 0 prior to each new scene. Several things were done to hide the code in memory. With effort, however, it can be traced and tested at various points to find where it actually checks for copy-protection.

My first thought was that it was checking for a nibble-count, but since copying track 0 with Locksmith's nibble counter didn't copy it, I suspect that it checks for something else. By tracing the machine language code and disabling various subroutines until I homed in on the right one, I discovered a place where the copy-protection could be circumvented. This was at location $989B where it does a JSR to $9E00. In assembly code, that's 20 00 9E.

I changed the bytes to EA, which is assembly code for NOP, or "No OPeration". Since the bytes I changed were 20 00 9E, it was not too difficult to scan the disk with DiskEdit until I found these three bytes, and changed them permanently. Making a backup of Sammy Lightfoot is very simple:

1) Boot up with DOS 3.3 System Master

RUN COPYA

2) Copy Sammy Lightfoot with COPYA.
3) Boot up a Disk Editor, such as DiskEdit.
4) Use your sector editor to make the following changes to the copy of Sammy Lightfoot.

Trk	Sect	Byte	From	To
0D	00	9B	20	EA
0D	00	9C	00	EA
0D	00	9D	9E	EA

You now have a working backup copy.

Unlimited Sammys

1) Using a sector editor, make the following changes to the disk and write the sectors back out:

Trk	Sect	Byte	From	To
0C	03	69	CE	EA
0C	03	6A	4F	EA
0C	03	6B	73	EA
0C	03	73	CE	EA
0C	03	74	4E	EA
0C	03	75	73	EA
10	0B	81	CF	EA
10	0B	82	4F	EA
10	0B	83	73	EA
10	0B	8B	CE	EA
10	0B	8C	4E	EA
10	0B	8D	73	EA

APT For Old Monitor ROM

When the game has begun play, hit RESET to get into the monitor. If you want to alter the playing level and/or the scene, use the following procedure once you are in the monitor:

1) Enter the level of play (0-B) at location $36B.
2) Enter the scene (0-3) at location $94E3.
3) Restart the game by typing

96C8G

►Screenwriter II

Sierra-On-Line, Inc.

Requirements:
Apple][+, //e, 48K
One disk drive
Screenwriter II master diskette
One blank diskette
FID or COPYA

By Daniel Price

The Screenwriter II word processor is a powerful writing tool, combining many advanced features with ease of use. The only problem is that you can't back it up. I found this particularly upsetting because the program is stored as a series of binary files on an *almost* standard DOS 3.3 diskette. This means that the diskette can be copied with FID or COPYA but the data that tells the copy protection routine that the diskette is an original is lost (the information is coded into the formatting of the diskette) and the program won't run. Fortunately, the technique to unlock this disk is very simple.

What we will do in this procedure is remove a machine language JSR (Jump to SubRoutine) instruction and bypass a particularly nasty subroutine which checks the disk to see if it is an original. If this routine found that the disk was a copy, it would clear the memory and reboot.

Step One: Make a backup of the diskette with either FID or COPYA and *hide the original!* I can't stress the importance of this enough. It is too easy to make a fatal mistake and have *your only copy destroyed.*

IF YOU USE FID: Boot the original disk. When the main menu appears, press ⌨C to enter BASIC. Remove your master diskette and insert your backup. Type the following

```
NEW
INIT START
DELETE START
```

Now use FID to copy all the programs which are on the master diskette onto the backup.

IF YOU USE COPYA: Just boot any DOS 3.3 diskette

```
RUN COPYA
```

and follow its directions.

Step Two: We will now make the actual changes to the program. These changes consist of a three-byte patch to two files on the diskette. Check to make sure your master diskette is hidden (just remember how much this program cost!) Now, with the backup in the drive, do the following

1) Enter the monitor

   CALL -151

2) Load the first file

   BLOAD RPART1

3) Make the first patch

   1F90:EA EA EA

4) Save the changes

   BSAVE RPART1,A$C00,L$1400

5) Load the second file

   BLOAD EDITORPART1.OBJ0

6) Make the second patch

   1F49:EA EA EA

7) Save these changes

   BSAVE EDITORPART1.OBJ0, A$C00, L$1400

The Screenwriter II is now unlocked and can be backed-up with COPYA or FID as many times as you like without needing any further changes.

If you use a different DOS, you must arrange to BRUN the file named START upon booting. This may be accomplished by creating a HELLO file to do it or by patching DOS directly.

The procedure to patch DOS 3.3 to BRUN a binary file upon booting is:

1) Boot a DOS 3.3 diskette.
2) Then type

   POKE 40514,52

Any diskette INITed with this DOS will BRUN whatever file you specified in the INIT command.

A note to those who own Quality Software's "Bag of Tricks": The INIT program's reskew function can be used to greatly increase the Screenwriter II's efficiency in loading, saving and packing files. Reskew the Screenwriter II program diskette (your backup!) tracks 3-22 to 9 DESCENDING and the TARGET and TEXT diskettes tracks 0-22 to 6 DESCENDING.

►Sneakers

Sirius Software

Requirements:
48K Apple with Applesoft in ROM
One disk drive
Snapshot Card
One blank disk

By David E. Rentzel

I used Snapshot to make a non-protected file of Sneakers. The problem is that during portions of the running game, the disk is accessed via copy-protected data to verify the original disk's presence.

This can be defeated by making two simple monitor changes:

4FE1:60
94D3:60

The program can now be saved and run without further disk access.

►Spy's Demise

Penguin Software

Requirements:
48K Apple][Plus or equivalent
Locksmith v4.1 & Nibbles Away II
Spy's Demise

By Peter M. Anker

I recently tried to backup a copy of Spy's Demise by Penguin Software according to the instructions given under the Copy II+ parameter list. For the disk I have, these parameters would not work properly. I would get only the title picture, but no game.

After some experimentation with other programs, I found that the disk would copy easily by using Locksmith 4.1 for tracks 0 to 12 (error 2 on track 12 is OK) and Nibbles Away II on tracks 1, 5 and 7. Locksmith was apparently not able to copy those tracks. No parameter changes were required for either copy program and it was not necessary to copy any other tracks.

►Starcross

Infocom, Inc.

Requirements:
Apple][48K
DOS master disk
COPYA program
Sector Editing program
One blank disk

By Jeff Rivett

Having just completed Starcross, I can say with certainty that it is one of the finest text adventures I have ever played. The puzzles are very logical and, although some are quite difficult, they can still be mastered by pure reasoning. In other words, you don't have to rely on luck to win the game.

You don't have to rely on luck to make a successful copy, either. The entire game program uses only tracks $00 through $18 (0-24) and track $00 is not protected. The protection scheme on the remainder of the disk is to change the start-of-data marks, normally D5 AA AD, to D5 AA BC.

Making A Copy Of Starcross

1) Boot from the DOS Master disk.

PR#6

2) Fix the check for $AD in DOS.

POKE 47358,0

3) Run COPYA and follow the prompts to copy the Starcross disk.

RUN COPYA

4) Use your disk edit program to change the following bytes;

Trk	Sct	Byte	From	To
0	2	FC	BC	AD
0	2	5D	BC	AD

The first modification allows the program to read the copied disk and the second allows the save game routine to write to a normal 3.3 disk.

You have deprotected Starcross. This copied version of Starcross can now be booted from slot 6.

Adding Your Own Text

Infocom programs don't use normal text files for program text. Instead, binary information is read directly off the disk into memory where some strange and wonderful alterations are performed to make it look like text to you and me. When a sector editing program is used to look at the copy disk, only the error message and the SAVE and RESTORE prompts are visible. If the text were decoded, it would be possible to add your own messages and personalize your copy.

Unfortunately, this isn't easy. After experimenting with my Starcross IOB copy for a while, I realized that the coding is probably not just a straight byte-for-ASCII-byte mapping. In fact, some values may represent whole words. I also suspect that a checksum is used on all text data because even the slightest change can cause the program to bomb. Although you may find that decoding the text in Starcross is quite a challenge, you now have the peace of mind of a backup copy on which to practice.

No List Programs

If you use DOS and would like to baffle your friends or protect your program listings from casual prying, then type the following line exactly as it is written into one of your programs. When you get to the ! type in a ⊖D. (The ⊖D is entered by holding the ⊖ key down and pressing the D key. The D should not print.)

The line on your screen should look like this:

0 REM IT'S NO FAIR IF YOU PEEK!FP

Save the program before you list it. When you LIST the program it should look like this:

0 REM IT'S NO FAIR IF YOU PEEK!

And that is all you will get. If you try to LIST the line again, it's not there.

If you count the characters from the 0 to the ! you'll get 33. Applesoft tries to LIST programs using 33 columns instead of the full 40. The 34th character is folded over and printed on the next line (There are exceptions). DOS gets control at the 34th character when fold over occurs and normally passes control back to Applesoft. However, if the 34th character is a ⊖D, then DOS thinks that it has been given a command and will process the remainder of the line accordingly. The FP at the end of the remark tells DOS to reset the Applesoft program pointers and has a similiar effect as the NEW command in Applesoft. You can replace the FP with any other DOS command. How about CATALOG?

Hidden Lines

Hiding a line or changing the visible portion is another neat trick. To do this, type in the following steps exactly as shown (press return after each step):

```
NEW
1REM12345672 REM HELLO!
5 A = PEEK(103) + PEEK (104) * 256 + 5
10 FOR X = 0 TO 6: POKE A + X, 8: NEXT
LIST
RUN
LIST
```

Notice anything different?

```
SPEED = 1
LIST
```

The REMark in line #1 has been overwritten by the second half of the REMark making it appear to be line #2. Line #5 PEEKs the start of program pointer and adds an offset to it. Line #10 changes the numbers 1 through 7 in the REMark into backspaces. The result is the apparently changed REMark. A line could be completely buried using this technique. Important GOSUBs and GOTOs could be disguised as REMarks. A second Copyright notice could be hidden this way. The list is endless. (Be sure to reset SPEED to 255, afterwards).

A Bomb

Zero page location 214 ($D6) is the run flag for Applesoft. If the number stored here is greater than 127 ($80) then the program in memory will AUTO-RUN each time you try to issue a command. In order to LIST the program or change a program line, the number in location 214 would have to be changed to a value smaller than 128. If you were to insert the following lines into your program it would be difficult for the uninformed to tamper with or change the program:

```
2 POKE214,255
3 IF PEEK(214) < > 255 THEN NEW
```

Line #3 should be inserted in the program in several different places (with appropriate line numbers).

Locking Your Program Into The Run Mode

This technique is often used to prevent unauthorized tampering. It's a neat trick to play on a friend and can be done by inserting the following line into the beginning of a program:

```
0 POKE 216,0: POKE 214,128: POKE1010,102:
    POKE1011,213: POKE1012,112: ONERR GOTO 0
```

Line #0 sets the RUN flag, changes the RESET vector to point to the RUN command in Applesoft and locks out the ⊖C. Now the program will restart each time you hit RESET or ⊖C.

NOTE: This will only work on an Apple with the autostart ROM.

►Ultima][

Sierra On-Line

Requirements:
48K Apple][Plus or //e
One disk drive with DOS 3.3
Ultima][: Program Master, Player Master, and Galactic disk
COPYA or similar disk copy program
Three blank disks

By Brian Burns & Dan Rosenberg

Owners of Ultima][may know how hard it is to backup. The copy-protection is tough to break because the data is stored differently than on normal DOS disks. Unlocking disks like Ultima is frustrating, mostly because it is often nearly impossible. Fortunately, there are shortcuts.

Because Sierra On-Line left a big hole in the copy protection of this adventure game, the disks are COPYAable with only slight modification to DOS. Programs like Locksmith and Nibbles Away usually have a hard time copying Ultima][. But they will do the job if you prevent DOS from reading the VTOC's from the disks. The VTOC is a sector on every normal DOS disk that tells on which track and sector the catalog starts (the catalog contains all the file names on the disk), and which version of DOS is on disk (3.2 or 3.3). It also contains a table that tells which sectors are being used to store programs and which are empty.

The VTOC's on the Ultima][disks have been filled with hex $FF's, which is why DOS gives an I/O error (it thinks the catalog starts at track $FF, sector $FF). You do know, of course, that track $FF, sector $FF doesn't exist, don't you? Ultima][doesn't get errors when it is reading from its own disks because its Disk Operating System is modified and doesn't need the VTOC to load programs.

Following the softkey, there is an Advanced Playing Technique for Ultima][which allows you to change a character's strength, wisdom, armor, weapons, race, hit points, etc. in the middle of the game. First complete the Softkey, because it modifies the program so it can be used with the APT.

How to Copy

1) Boot your system master or any regular DOS 3.3 disk.
2) Enter the monitor

   CALL -151

3) Type

AFF7G

This allows the reading of the VTOC from the normal DOS 3.3 disk into memory.
4) After the drive stops, enter

AFF7:60
AFFD:60

This keeps DOS from writing or reading the altered VTOC from the Ultima][disks and thus prevents errors when copying the disks.
5) Run COPY or COPYA. Copy all three Ultima][disks as you would normally (yes, copy the Player Master disk this way, even though it is normally COPYAable). If you have a character disk you want to keep, also copy it.
6) Boot your System Master or any regular disk and enter the monitor again by typing

CALL -151

7) Enter the following short program

300:20 F7 AF 20 0C FD 20 FD AF 60

This program will copy the normal VTOC from the System Master to the copied Ultima][disks.
Put in the System Master and type

300G

DOS then will read the normal VTOC into memory. When a cursor appears, insert a copied Ultima][disk and push a key. If the Apple beeps or nothing happens, start over from Step 6. When you push a key, the drive should whir and write the normal VTOC in memory to the copied Ultima][disk. Repeat the procedure by putting in another of the copied disks and typing

303G

Also do this for the last Ultima][disk. If you also have a copied character disk, insert it and type

303G

It will put a normal VTOC on that disk, as well.
8) Now insert your copied Ultima][Program Master and type

BLOAD HELLO

(Yes, you can do this from the monitor.) Make the following changes:

72E0: A9 4C 8D F8 03 A9 79 8D
72E8: F9 03 A9 50 8D FA 03 60

Now type

UNLOCK HELLO
BSAVE HELLO,A$60000,L$1420
LOCK HELLO

This modification keeps Ultima][from testing the disk to see if it is a copy (if it is, Ultima will crash), prevents it from booting the disk when reset is pushed, and sets up a ⊡Y jump back into the program for use when you alter your character in the following APT.

Your Ultima][is now copied and ready to be played.

Ultima APT

Now that you can push reset in the middle of the game without booting the disk, you can edit your character to your heart's content. For example, if you have only one unit of food and you are stranded in the middle of nowhere, miles and years away from a town, push reset. (If you are on a horse or frigate do not push reset or you will lose whatever transportation you are using. You first should get off whatever it is by pushing X for Exit and then reset. When you come back to the game, just hit B for Board.)

Hitting reset should leave you in Applesoft. Enter the monitor with

CALL -151

Now you can change your character's food, hit points, or whatever else you need by just entering the appropriate address from the Address Chart (page 00), a colon (:) and the value you wish to have in decimal (00-99). You should only enter values in hexadecimal where noted in the list of addresses. If you ever need to know a value, type in the address and hit return. For example, to gauge your strength, enter

4E15

You should see "4E15- 16" or whatever your strength may be.

You do not necessarily have to be in the middle of a game to edit your character. Simply insert the character disk, type

BLOAD PLAYER
CALL -151

and you are ready to change your character. Since your character

is stored in memory $4E00 to $4EFF, when you are done you should enter

BSAVE PLAYER, A$4E00, L$100

NOTE: If the address is two bytes, as food and hit points are, put the first two digits (in decimal), a space, and then the last two digits (in decimal, also). Say, for example, you wanted to change your food to 487. You would push reset, CALL -151, and 4E1D:04 87. To get back into the game, enter ⊖Y.

It is important never to save a new file onto one of the copied Ultima][disks, since this may write over the other programs on the disk. A new program means one which is not already on the disk. It is all right to save your character (file name PLAYER) to your character disk, since that file has always been there. Accidentally saving a new file on the disk may necessitate making a new copy from scratch.

The address list contains all the addresses we have found. The addresses followed by question marks are unknown, but their purposes may be revealed by further experimentation. You can do this by changing the unknown value and seeing how it affects your location and/or status. Some of the effects are strange, and it would be advisable to turn off the computer if it gets bizarre to avoid accidentally storing jumbled data on your disk.

Location	Item or Characteristic
$4E00-$4E0F	Name (up to 15 letters)
$4E10	Sex (M for male, F for female)
$4E11	Class of character: 0=fighter, 1=cleric, 2=wizard, 3=thief
$4E12	Race of character: 0=human, 1=elf, 2=dwarf, 3=hobbit
$4E13-$4E14	Time Zone/Surface Flag
$4E15	Strength
$4E16	Agility
$4E17	Stamina
$4E18	Charisma
$4E19	Wisdom
$4E1A	Intelligence
$4E1B-$4E1C	Hit points
$4E1D-$4E1E	Food
$4E1F	??
$4E20-$4E21	Experience points. Location $4E20 is also the level of your character.
$4E22-$4E23	Gold pieces
$4E24-$4E25	Location of player on map. This is an X, Y value. For example, change these bytes when you are stuck on an island to move to the nearest land mass. (Use hex values for X and Y)
$4E26-$4E2A	??
$4E2B	Weapon in hand. This is the weapon you are using. You don't have to own the weapon to use it. For instance, you may change this to "phaser" without having a phaser in your possession or even being able to wield it. 0=Hands, 1=Dagger, 2=Mace, 3=Axe, 4=Bow, 5=Sword, 6=Great sword, 7=Light sword, 8=Phaser, 9=Quick sword
$4E2C	Type of armour that you are wearing. The same applies to armour as to weapons. 0=Skin, 1=Cloth, 2=Leather, 3=Chain, 4=Plate, 5=Reflect, 6=Power
$4E2D	Spell. This is the spell you are ready to cast. Unfortunately, you must own the spell in order to cast it, but you can change that! 0=None, 1=Light, 2=Ladder Down, 3=Ladder up, 4=Passwall, 5=Surface, 6=Prayer, 7=Magic missile, 8=Blink 9=Kill
$4E2E	Torches
$4E2F	Keys
$4E30	Tools
$4E31-$4E40	??

Each byte of this section represents how many of each item you have (i.e. a $15 at location $4E41 means you have 15 daggers, a $78 at location $4E43 means 78 axes, etc. See $4E2B).

Location	Item	Location	Item
►WEAPONS			
$4E41	dagger	$4E42	mace
$4E43	axe	$4E44	bow
$4E45	sword	$4E46	great sword
$4E47	light saber	$4E48	phaser
$4E49	quick sword		
►ARMOUR			
$4E61	cloth	$4E62	leather
$4E63	chain	$4E64	plate
$4E65	reflecting	$4E66	power
►SPELL			
$4E81	light	$4E82	ladder down
$4E83	ladder up	$4E84	passwall
$4E85	surface	$4E86	prayer
$4E87	magic missile	$4E88	blink
$4E89	kill		
►MISC.			
$4EA0	ring	$4EA1	wand
$4EA2	staff	$4EA3	boots
$4EA4	cloak	$4EA5	helm
$4EA6	gem	$4EA7	ankh
$4EA8	red gem	$4EA9	skull key
$4EAA	green gem	$4EAB	brass button
$4EAC	blue tassle	$4EAD	strange coin
$4EAE	green idol	$4EAF	tri-lithium

►Ultima][

Sierra On-Line, Inc.

Requirements:
Ultima][, 3 disks
One disk drive
COPYA (On 3.3 System Master)
Sector editing program, such as DiskEdit
3 blank disks

By Pat Tilsworth

Ultima][from Sierra On-Line is the second of the three great fantasy adventures written by Lord British. Faster play, less disk flipping and greater length make this game a tremendous improvement over the first Ultima.

When trying to backup Ultima][, I noticed that the Program Master seemed to copy easily with COPYA. When booting the duplicate, however, I found that the HELLO program seemed to be checking for a nibble count. This protection scheme relies on the slight difference in speed between the original copying drive and any other drive (i.e. yours). The unique number of nibbles copied at the original drive speed is stored on the Ultima][disk and accessed by the HELLO program when Ultima][is booted. When the HELLO program compares nibble counts, the count of the duplicate will always differ from the count the program requires to run, because the duplicate was copied at another speed.

Copying Ultima][

I wasn't about to nibble-count every track of the Player Master with a nibble copier so I set off to unprotect it. The modification needed would have to prevent the HELLO program from checking for the nibble count. This softkey also allows each Ultima][disk to be catalogued, enabling them to be used with the Ultima][Character Generator (Published in Hardcore COMPUTIST No. 4).

1) Boot the 3.3 system master disk.

   PR#6

2) Run the COPYA program.

   RUN COPYA

3) Copy all three disks of Ultima][with COPYA.
4) When finished, boot your disk editor. It will be used to

modify each Ultima][disk.
5) Insert the copy of the Ultima][Program Master into your disk drive.
6) Read track $11 (17 decimal), sector $00.
7) Modify the bytes found at the following locations (Don't forget, the first byte of the sector is location 00.)

Byte	From	To
$01	$FF	$11
$02	$FF	$0F

This modification allows the disk to be catalogued by pointing to track $11, sector $0F.
8) Write the sector back to the disk.
9) Perform Steps 6-8 on the copies of the Player Master and Galactic disks.
10) Place the copy of the Program Master into your drive.
11) Read track 3, sector C.
12) Modify the following values:

Byte	From	To
$84	$20	$EA
$85	$E0	$EA
$86	$72	$EA

This final modification prevents the HELLO program from performing the nibble-count check routine at $72E0. (Location $84 was a JSR to the nibble-count check.)
13) Write the sector back to the disk.

You now possess an unprotected version of Ultima][, and the Player Master can be catalogued for use with the Ultima][Character Generator. Files created under normal DOS 3.3 should not be saved to these disks since DOS 3.3 does not know where the real Ultima VTOC exists. However, a program such as FID can be used to copy all the Ultima files onto normal 3.3 disks.

In addition, since the nibble count has been bypassed, the three unprotected Ultima disks will now boot when duplicated with any program which copies an entire disk.

►Visifile

VisiCorp

Requirements:
48K Apple or an Apple //e
Visifile
Two blank disks
Apple's COPYA program
A disk edit program
(An Applesoft Program Line Editor, such as Konzen's GPLE, is useful but not essential)

By Bob Bragner

Visifile is a medium-powered, somewhat overpriced data base manager. My first (original) copy got zapped when the Turkish Electric Company hiccuped during a configuration file write on the master disk. Since I didn't have a backup and I knew that the disks were protected, I packed both of them off to VisiCorp along with a check for $30 for a replacement.

After nearly two months, the disks finally made their way back across the Atlantic and Mediterranean with the enchanting message: "Undeliverable at this Address" stamped on the package! VisiCorp had apparently moved and not notified the Post Office.

By this time I had, of course, found their new address (no thanks to them) and once again shipped the disks off with a somewhat caustic letter. This time the disks were returned updated and with a backup to boot (sorry for the pun) in about three weeks. Nevertheless, having been burned once, I decided I had to have my own copyable Visifile.

Locksmith will copy Visifile, but requires a lot of annoying parameter changes, and the copy will remain protected. What I really wanted was a "cracked" version and backups squirrelled all over the place.

Pirate's Harbor published a crack for Visifile. It consisted of copying the disk with COPYA, then changing one byte in one of the sectors on the disk using a disk zap utility like Watson. However, COPYA refused to copy my disk. Every time I tried it, I got an "****** UNABLE TO WRITE ******" error when the program tried to format the blank disk. Using Watson, I was able to determine that there were no protected sectors on the original disk. FID could move all the files (except for the dummy serial number) over to another disk, but if you try to boot the result, the screen fills up with inverse "A's".

After using the FIXCAT utility from Bag of Tricks on the original, it was clear that there were some peculiar things in the

catalog track. For one thing, the volume number appeared to be 255 ($FF: an invalid volume number!) even though it showed up as 254 when you looked at the catalog. If you examine line 250 of the COPYA program you will see:

```
250 PRINT "INITXXX,S";SS; "D";SD; ",V";PEEK (714 ) :FT = 1
```

Checking the value at location 714 after COPYA crashes reveals that there is indeed a 255 there. So if you changed line 250 by adding a "- 1" after the "PEEK (714)" then COPYA would make a perfect copy of both Visifile disks. These copies can be copied as much as you like by a normal, unaltered COPYA. However, if you try to boot Disk 1, you still get a screenful of reversed "A's."

After a bit more snooping, it was easy to determine that the blowup occurred when the file VISIFILE.BIN on Disk 1 was BRUN. A quick disassembly of this file didn't reveal anything significant (although there is a section where there are a bunch of reversed "A's") but then I remembered the Pirate's Harbor crack: byte $2D of track $22, sector $04, was supposed to change from $0A to $0F and this sector was part of the VISIFILE.BIN file!

After making this change with Watson, I booted the resulting disk and all was well.

Here is a step-by-step procedure to crack Visifile:

1) First load COPYA.

LOAD COPYA

2) Edit line 250 by inserting "-1"after the PEEK(714).

250 PRINT 'INITXXX,S' SS 'D' SD ',V' PEEK (714) - 1 :FT = 1

3) If GPLE is lurking around, remove it before you attempt to make a copy.

4) Run the program and follow normal copy procedures.

RUN

(Repeat Step 4 for Visifile Disk 1 and Disk 2.)

5) Enter your favorite disk zapper and read track $22, sector $04 of the copy of disk 1. Change byte $2D from $0A to $0F. Write this change to the copied disk.

You now have a cracked copy of Visifile from which you can make all the backups you want, using normal copy procedures. Do you want a faster sort routine? Hard disk capability? With your cracked Visifile, you are now free to modify to your heart's content.

►Visiplot/Visitrend

VisiCorp

Requirements:
48K Apple with Applesoft in ROM
One disk drive
Visiplot/Visitrend
One blank disk

By Anthony L. Barnett

A government department for which I work recently purchased Visiplot/Visitrend. Naturally, a backup disk was desired. However, the only "legal" way of obtaining one appeared to be by making an overseas order directly to VisiCorp.

This is by no means an easy procedure. So, a letter was sent to VisiCorp at the address in the manual. This was promptly returned by the US Post Office as "undeliverable at this address". Recent magazines were perused to find VisiCorp's current address and the letter posted again.

VisiCorp was asked whether the order for a backup could be placed through an Australian agent. Eventually, the terse reply of "no" was received scribbled over a standard form which advised, among other things, that our request could not be met as we had not sent our disk backup order form!

Not knowing the Locksmith parameters, I began to examine this curious disk for other means to back it up. All the programs are quite listable and FIDable but a disk check causes a spectacular crash if the original disk is not used.

I determined that the disk check occurs in the main storage program and, after studying the listing for about an hour, I determined that six bytes needed to be altered to get the backup to run.

In line 4 the "& A" should be replaced with two colons and, in line 2300, the "CALL 960" should be replaced with four colons.

As the disk check is now eliminated, the backup works slightly faster when switching to and from main storage. It is also possible to use Speed-DOS from Hardcore Computing Update 3.2 (old series). The switching between programs is then quite fast and tolerable.

It is my view that no program should be protected. Failing this, at least two copies of a business program should be provided. This can be done in the package or as a free backup on receipt of registration. Another less satisfactory means is to provide a special user copy program (usually "once only" like Multiplan).

►Wizardry

Sir-Tech

Requirements:
48K Apple with Applesoft in ROM
Locksmith 4.1
One blank initialized disk
At least one disk drive
One small Phillips screwdriver
One small standard screwdriver (see Step 7, option C)

By John Samborski

According to the authors of Wizardry, their program uses "state-of-the-art copy-protection." This label fits very well, as it is truly a state-of-the-art program. Robert Woodhead and Andrew Greenberg anticipated the popularity of Wizardry when they designed their protection scheme. Unfortunately, it's the hardest disk backup chore I've ever faced.

For all who want the security of a backup of Wizardry, this article provides a complete set of instructions for making a copy. The boot side, then the scenario side, will be duplicated using Locksmith 4.1.

Copying The Boot Side

1) Boot Locksmith 4.1.
2) If using one drive, remove Locksmith and insert the Wizardry disk. If two drives are available, insert the Wizardry disk in drive 2.
3) Use the "Automatic Error Retry" option on all tracks listed.
4) Copy tracks 0-22 unsynchronized.
5) If all is well (it should be), set parmameter 36 to 01.
6) Copy tracks 0A-0E synchronized.

Step 7: Adjusting The Drive Speed

The Wizardry program checks for "preservation of nibble count." Unfortunately, when this kind of protection scheme is used the drive speed must be absolutely perfect to make a successful copy. Locksmith will do the normal analysis, but when it reaches the point of writing and verifying, some strange digits will be printed on the screen such as >001D or <000A. These figures indicate the speed difference between the original recording drive and the drive you are using. If the sign is ">", the drive is running slow. If "<" appears, it's running fast. At this point, there are three options available. Read each before

deciding which is appropriate:

A) Do nothing. The Apple will try to compensate the speed. Judging by the difference in drive speed, this can take anywhere from three minutes to three weeks. This is recommended only for perfectly adjusted drives.

B) Use the "<" and ">" keys to correct the drive speed. To do this, look at the sign in front of the digits and hit that key. For example, if >001A appears on screen, hit the ">" (shifting is unnecessary). When this key is hit, the bell will ring. Press the space bar to continue. The longer you let the bell ring, the more the speed will be adjusted. Repeat this as needed. When the speed is adjusted to within 0006 (>0006 - <0006), leave it alone and let the drive try to compensate the remainder by itself.

NOTE: For option C, use a blank disk.

C) If the drive speed is substantially off, step B is impractical. The speed will have to be compensated by adjusting a screw inside the drive with a small Phillips screwdriver and a small standard screwdriver. Follow this procedure

Turn the Apple off.

Unscrew the four Phillips-head screws which hold the drive cover in place.

Slide the cover to the rear and off of the drive so that the tiny screw which controls drive speed can be located. (It's not on the circuit board — leave all screws on the circuit board alone.) It is by the rear cover, mounted horizontally with its head to the right side of the drive. This screw will be used later to correct the drive speed.

Turn the Apple on and boot Locksmith 4.1.

Set parameter 36 to 01.

Copy tracks 0A-0E synchronized.

When the digits appear on screen showing how far off the drive speed is, use the standard screwdriver to turn the small screw which controls speed. Turn the screw in the direction that was indicated by the ">" or "<": right increases the speed, left slows it down.

When the speed comes within 0009 (>0009-<0009), use the "<" and ">" keys for fine adjustment.

Replace the drive cover.

Back To The Original Procedure

8) When the digits indicate >0000, the track has been copied. The user will be prompted to insert the source disk (one drive) or, if two drives are being used, jump to the source drive.

Assure that >0000 is printed on screen before reading the next track. Sometimes the program "gets tired" of trying to synchronize the drive speed (some drives only). If >0000 isn't printed, the copy probably didn't work.

9) Finish copying the boot side, then put a write-protect tab on the copied disk.

10) Place the copy in the drive and boot it.

If you see that pretty picture and the menu, congratulations! You're now half done.

If the copy wasn't successful, repeat the ten steps. It works about three times out of five for me. The protection scheme is a tough one.

Copying The Scenario Side

The scenario side of Wizardry can be copied using the same basic procedure that was used for the boot side. Repeat Steps 1-10, but leave out Step 9 since the program writes to the disk as it goes along.

Don't be discouraged if it doesn't work the first time. This side is even tougher to copy than the boot side. On my attempts it worked about two out of nine times.

Enjoy the added peace of mind you have with a backup copy of Wizardry. I only use my backup; the original sits in a dark, dry place, safe from magnetic fields.

►Wizardry

Sir-Tech

Requirements:
COPYA (optional)
Locksmith
Wizardry

By Greg Burns

Looking through your last Hardcore issues, I saw on the parameter exchange how to backup Wizardry by Sir Tech. While the program uses state-of-the-art copy protection, there is a much simpler way of making backups and it works every time, not just 3 out of 5 times.

First, copy tracks 0-22 unsync with auto retry. Or if, like me, you hate using Locksmith because it is so slow, you can use COPYA to copy the disk. After copying the disk with Locksmith or COPYA, go back to Locksmith and copy track 0A-0E SYNC and change these to parameters 46=96, 21=02.

That's it, and have fun.

►Zork I

Infocom, Inc.

Requirements:
Apple][
At least one disk drive
A copy of Zork
COPYA
A disk editing program such as DiskEdit

By Bobby

This copy method works on Zork versions I, II, and III. It also works for Deadline and Witness.

Zork is a challenging game and although it lacks a hi-res picture (it is all text), is one of the best adventure games I have ever attempted.

While trying to solve some of the puzzles, I started to do a little APT and found that Zork was on a protected disk. I set it aside until I had the time to examine the program but then a reader called to explain a method to unprotect Zork. Believe it or not, the COPYA program on the system master disk can be used.

How To Copy Zork

1) Insert the DOS master disk and run COPYA.

RUN COPYA

2) Once loaded, stop the program

CTRL-C

3) Delete line 70 so the machine language subroutine will not reload.

DEL 70

4) Enter the Monitor and make the following changes:

CALL -151	Enter monitor
B925:18 60	Ignore end of data marks
B988:18 60	Ignore end of address marks
BE48:18	Ignore errors
B8FE:00	Ignore 3rd byte of start of data mark
3D0G	Exit to basic

5) Restart the copy program

RUN

6) Follow the prompts to make a copy.
7) After the disk is copied, use a disk editing program to read track 0, sector 2 and make these changes:

Byte	From	To
5D	BC	AD
FE	E7	00

You now have an unprotected disk that can be copied with various copy programs, including COPYA.

The disk cannot be catalogued, nor may separate files be run; it must be booted to play the game. But Zork is now open to inspection by those wishing to participate in the rapidly growing hobby of APT.