

```
1 .TITLE ALDISP - ALIENS DISPLAY FUNCTIONS
2 .SBTTL *****
3 .SBTTL *
4 .SBTTL *MODULE ALDISP *
5 .SBTTL *PROGRAMMER DAVE THEURER *
6 .SBTTL *FUNCTION ALIENS DISPLAY FUNCTIONS*
7 .SBTTL *
8 .SBTTL *****
9
10 .NLIST
11 .INCLUDE ALCOMN
12 .PAGE
13 .LIST
14 .PAGE
15 .SBTTL GLOBALS
16
17 ENTRY POINTS
18 .GLOBL VGADD,VGJSRL,VGVCTR,GETDSP,LDRDSP,VGCNTR,SWAPVG,VGDOT
19 .GLOBL VGADD2,VGHEXZ,DISPLA,VGHALT,INIDSP,JSRDOT,VGADD3
20 .GLOBL DPRSTA,D2GAME
21 .GLOBL INFO,RQRDSP,DSPHOL
22 .GLOBL VGRDSL,DGOVER,DPLPLA,PICLO,PICHI
23 .GLOBL INITEM,VGYABS,VGYAB1,INICOL
24 TABLES
25 .GLOBL INVERSE,INVEXP,D07MSK,BOXPRO,LOGPRO,PTTANP,PTTANF,PTSPLF
26 .GLOBL VGBRIT,VGLIST,VGSIZE,XCOMP,D70MSK,SCALE,DSPSYS
27 .GLOBL VGSCA1,VGVTR1,VGVTR2,VGSCAL,VGSTAT,VGSTA1
28 .GLOBL PTSTR1,PTEXP1,PTCURS,PTSPI1,PTTANK,PTESHO,PTSPLA,PTSPAR
29 .GLOBL BCINFO,BCCURS,BCSHOT,BCINVA,BCEXPL,BCNYMP,BCINFO,BCENEL
30 .GLOBL BUFBSL,BUFBSH,BUFASL,BUFASH,JMPMAL,JMPMAH,BCWELL,BUFSWL,BUFSWH
31 .GLOBL JMPALO,JMPAHI,JMPBLO,JMPBHI,BCSTAR,BFASTA,BFBSTA,PTFUSE,PTFUSX
32 .GLOBL PPSPXI,CPSPXI,FPSPXI,KILLER
33 .GLOBL QCHKS6,QCHKS7,QCHKS8
34 RATS OCO
35 MZCOLO 8 NEW COLOR STAT BIT MASK
36 MZBRIT 0 NEW INTENSITY STAT BIT
37
38 .SBTTL DISPLAY-MAINLINE
39
40 FUNCTION USING THE DATABASE SET UP BY THE GAME PORTION OF THE PROGRAM,
41 BUILD, IN THE AVAILABLE BUFFER, THE VECTOR GENERATOR DISPLAY LIST
42
43 INPUT DATABASE
44
45 SPACG 0 SUPPRESS SPACE GAME CODE
46 .NLIST CND
47 .CSECT
48 DISPLAY JSR INIMAT SET UP MATH BOX
49 LDA VECRAM
50 CMP JMPMAL+4
51 IFEQ TRYING TO HALT
52 LDA SPARE3 YES.
53 IFEQ HALT YET
54 RTS NO. GO AWAY
55
56 ENDIF
57 ENDIF
58 LDA QDSTATE
59 CMP I,CDPLAY
60 IFNE ANYTHING BUT PLAY STATE
LDA I,BCINFO YES. DEFAULT TO INFO BUFFER
```

```
1 JSR SBCLOG
2 JSR BIGTEX
3 IFCC SET UP LARGE BUFFER
4 BUFFER AVAILABLE FILL IT
5 JSR DSTATE EXECUTE DISPLAY STATE
6 ZATVG2
7 LDA SECUVY
8 IFNE ATARI ON SCREEN
9 LDY I,27 YES. VERIFY
10 LDA I,0E
11 SEC
12 BEGIN
13 SBC NY,SECUVG
14 DEY
15 MIEND
16 TAY
17 IFNE
18 EOR I,0E5
19 ENDIF
20 IFNE
21 EOR I,029
22 ENDIF
23 STA QT3
24 ENDIF
25 ENDIF
26 LDA I,BCINFO
27 JSR SBCSWI
28 LDA JMPMAL+2
29 STA VECRAM
30 LDA JMPMAH+2
31 STA VECRAM+1
32 ELSE
33 JMP DENORM PLAY STATE
34 ENDIF
35 RTS
36 .PAGE
37 .PAGE
38 .SBTTL DISPLAY STATE EXECUTOR
39 DSTATE
40 LDX QDSTATE
41 LDA X,DROUTAD+1
42 PHA
43 LDA X,DROUTAD
44 PHA
45 NOOPR RTS
46 DROUTAD
47 .WORD DENORM-1 GAME PLAY - TOP OF WELL, DOWN THE TUBE
48 .WORD DSPSYS-1 SYSTEM CONFIGURATION
49 .WORD DSBOOM-1 GAME PLAY - BOOM
50 .WORD GETDSP-1 DATA ENTRY - HI SCORE INITIALS
51 .WORD RQRDSP-1 DATA ENTRY - RANKING
52 .WORD LDRDSP-1 INFO ONLY - HI SCORE TABLE
53 .WORD DGOVER-1 GAME OVER PLAYER X
54 .WORD DPLPLA-1 PLAY PLAYER X
55 .WORD DPRSTA-1 PRESS START
56 .WORD BOXPRO-1 LOGO BOX
57 .WORD LOGPRO-1 LOGO
58 .WORD D2GAME-1 2 GAME MINIMUM
59 DROUTEN
60 .PAGE
```

```
1 .SBTTL DISPLAY-GAME PLAY MAINLINE
2
3 DENORM DISPLAY CURSOR
4 LDA I,BCCURS
5 JSR SBCLOG
6 JSR DSPCUR
7 LDA I,BCCURS
8 JSR SBCSWI
9 DISPLAY CHARGES
10 LDA I,BCSHOT
11 JSR SBCLOG
12 JSR DSPCHG
13 LDA I,BCSHOT
14 JSR SBCSWI
15 DISPLAY INVADERS
16 LDA I,BCINVA
17 JSR SBCLOG
18 JSR DSPINV
19 LDA I,BCINVA
20 JSR SBCSWI
21 DISPLAY EXPLOSIONS
22 LDA I,BCEXPL
23 JSR SBCLOG
24 JSR DSPEXP
25 LDA I,BCEXPL
26 JSR SBCSWI
27 DISPLAY NYMPHS
28 LDA I,BCNYMP
29 JSR SBCLOG
30 JSR DSPNYM
31 LDA I,BCNYMP
32 JSR SBCSWI
33 DISPLAY INFORMATION SCORES, MSGS, ETC.
34 LDA I,BCINFO
35 JSR SBCLOG
36 JSR INFO
37 ZATVG1
38 LDA QSTATUS
39 IFPL ATTRACT
40 LDA I,OF2 YES. ATARI BETTER BE ON SCREEN
41 CLC
42 LDY I,39.
43 BEGIN
44 ADC NY,SECUVG
45 DEY
46 MIEND
47 STA QT6 SAVE RESSLT SHOULD BE 0
48 ENDIF
49 LDA I,BCINFO
50 JSR SBCSWI
51 DISPLAY WELL
52 JSR DSPWEL DISPLAY WELL
53 LDA I,BCENEL DISPLAY ENEMY LINES
54 JSR SBCLOG
55 JSR DSPENL
56 LDA I,BCENEL
57 JSR SBCSWI
58 LDA I,BCSTAR DISPLAY STAR FIELD
59 JSR SBCLOG
60 JSR DSTARF
```

```
1 LDA I,BCSTAR
2 JSR SBCSWI
3 LDA I,0
4 STA ROTDIS
5
6 LDA JMPMAL          SET MASTER POINTER TO JSRL
7 STA VECRAM          LIST FOR SUBLISTS CREATED ABOVE
8 LDA JMPMAH
9 STA VECRAM+1
10
11 RTS
12 .PAGE
13 .SBTTL  BUFFER CONTROL
14
15 INPUT ACC SUB BUFFER GROUP INDEX CODE
16 OUTPUT VGLIST 2     VGY SET UP TO VACANT BUFFER
17 ACC,X,Y DESTROYED
18 SBCLOG
19 TAX                SET UP VECTOR RAM POINTS TO
20 ASL                UNUSED BUFFER
21 TAY
22 LDA X,BUFACT
23 IFEQ              BUFFER A OR B ACTIVE
24 LDX Y,BUFBSL      A IS CTIVE. BUILD IN B
25 LDA Y,BUFBSH
26 ELSE
27 LDX Y,BUFASL      B IS ACTIVE. BUILD IN A
28 LDA Y,BUFASH
29 ENDIF
30 STX VGLIST
31 STA VGLIST+1
32 LDA I,0
33 STA VGY
34 RTS
35
36                OPPOSITE OF SBCLOG-PLACE PTR
37                TO ACTIVE BUFFER INTO INDYLO
38 SBCACT TAX
39 ASL
40 TAY
41 LDA X,BUFACT
42 IFEQ
43 LDX Y,BUFASL      A IS ACTIVE
44 LDA Y,BUFASH
45 ELSE
46 LDX Y,BUFBSL      B IS ACTIVE
47 LDA Y,BUFBSH
48 ENDIF
49 STX INDYLO
50 STA INDYLO+1
51 LDA I,0
52 STA VGY
53 RTS
54 INPUT ACC SUBBUFFER GROUP INDEX CODE
55 OUTPUT RTS ADDED TO END OF NEWLY BUILT BUFFER
56 SWITCH SET TO POINT TO NEW BUFFER
57 BUFACT X FLIPPED INDICATING NEW BUFFER ACTIVE
58 SBCSWI PHA
59 JSR VGRDSL          INSERT RTSL AT END OF BUFFER
60 PLA
61 TAX
```

```
1 ASL
2 TAY
3 LDA Y,BUFSWL SET UP SWITCH LOCATION
4 STA INDYLO
5 LDA Y,BUFSWH
6 STA INDYHI
7 LDA X,BUFACT
8 EOR I,01
9 STA X,BUFACT
10 IFEQ WHICH IS THE NEW BUFFER TO DISLAY
11 LDA Y,JMPALO BUFFER A
12 LDX Y,JMPAHI
13 ELSE
14 LDA Y,JMPBLO BUFFER B
15 LDX Y,JMPBHI
16 ENDIF
17 LDY I,0 UPDATE SWITCH TO PT TO
18 STA NY,INDYLO NEW BUFFER
19 TXA
20 INY
21 STA NY,INDYLO
22 RTS
23
24 BIGTEX ASSIGN LARGE BUFFER FOR TEXT
25 LDA JMPMAL+2
26 CMP VECRAM
27 IFNE BEEN HERE BEFORE
28 STA VECRAM NO. SET UP MASTER POINTER FOR TEXT ONLY.
29 SEC
30 RTS EXIT
31 ENDIF
32 LDA BUFACT YES. INSERT JMP TO AREA WITH MORE ROOM.
33 IFEQ
34 LDX I,02 BIG AREA 1 1ST HALF OF VECRAM
35 ELSE
36 LDX I,08 BIG AREA 2 2ND HALF OF VECRAM
37 ENDIF
38 LDA X,JMPALO
39 LDY I,0
40 STY SECUVY
41 STA NY,VGLIST
42 INY
43 LDA X,JMPAHI INSERT JMPL TO AREA WITH MORE ROOM
44 STA NY,VGLIST
45 LDA X,BUFASL POINT VGLIST AT NEW AREA
46 STA VGLIST
47 LDA X,BUFASH
48 STA VGLIST+1
49 CLC
50 RTS
51 .PAGE
52 .SBTTL DISPLAY-WELL
53 CSUSTA 3
54 CSUINT 1
55 DSPWEL
56 LDA ROTDIS
57 IFNE REBUILD WELL
58 LDA I,BCWELL
59 JSR SBCLOG
60 JSR BLDWEL YES
```



```
1 LDA I,BCWELL
2 JSR SBCSWI
3 ENDIF
4 LDA I,BCWELL          SET UP PTR TO ACTIVE WELL BUFFER
5 JSR SBCACT
6
7 .SBTTL  DISPLAY-SPOKE COLORS
8
9 .SBTTL  DISPLAY-SPOKE PULSE STATUS
10
11 LDA I,0
12 LDX I,NLINES-1
13 BEGIN                LOOP FOR EACH SPOKE
14 STA X,SPOKST          CLEAR SPOKE PULSE STATUS
15 DEX
16 MIEND
17 LDA CURMOD
18 IFPL                  CURSOR AT TOP
19 LDX WINVMX            YES.
20 BEGIN                LOOP FOR EACH INVADER
21 LDA X,INVAY
22 IFNE                  ACTIVE INVADER
23 LDY I,0                YES. DEFAULT
24 LDA X,INVAC1
25 AND I,INVABI
26 CMP I,ZABPUL
27 IFEQ                  PULSAR
28 INY                    YES. SET PULSAR BIT D0
29 STY TEMPO
30 LDA X,INVAC1          YES
31 AND I,INVMOT
32 IFEQ                  FLIPPING
33 LDA PULSON            NO.
34 IFPL                  PULSARS ON
35 LDA X,INVAY          YES.
36 CMP PULPOT
37 IFCC                  POTENT PULSAR
38 INC TEMPO            YES. SET PULSE BIT D1
39 INC TEMPO
40
41 ENDIF
42 ENDIF
43 LDA TEMPO              SET CCW LEG STATUS
44 LDY X,INVAL2
45 ORA Y,SPOKST
46 STA Y,SPOKST
47 ENDIF
48 LDY X,INVAL1
49 LDA TEMPO
50 ORA I,80              SET BASE BIT
51 ORA Y,SPOKST
52 STA Y,SPOKST
53 ENDIF
54 ENDIF
55 DEX
56 MIEND
57 ENDIF
58 LDA I,WELCOL          DEFAULT WELL COLO
59 LDY SUZTIM
60 IFNE
61 IFPL                  SUPERZAPPER ACTIVE
```

```
1 LDA QFRAME YES. SUPERZAPPER IS DEFAULT
2 AND I,7
3 CMP I,7
4 IFEQ
5 LDA I,1 NO BLACK
6 ENDIF
7 ENDIF
8 ENDIF
9 STA TEMPO DEFAULT COLOR
10 LDY I,-1
11 LDX I,-1
12 STX TEMP3 DEFAULT NO BONUS FLASH
13 LDA CURSY
14 IFNE C URSOR ALIVE
15 LDA CURSL2
16 IFPL
17 LDX CURSL1 YES.
18 LDY CURSL2
19 ENDIF
20 ENDIF
21 STX TEMP1 SAVE FLASLIGHT SPOKES
22 STY TEMP2
23 LDA BOFLASH
24 IFPL BONUS FLASH
25 AND I,0E YES. SET BASE COLOR
26 LSR
27 STA TEMP3
28 DEC BOFLASH
29 ENDIF
30 LDX I,NLINES-1
31 BEGIN LOOP FOR EACH SPOKE
32 LDY I,WELCOL DEFAULT WELL COLOR
33 LDA X,SPOKST
34 IFNE PULSE
35 AND I,2
36 IFNE YES. PULSING
37 LDA QFRAME
38 AND I,1
39 TAY
40 ENDIF
41 ELSE
42 CPX TEMP1 NO.
43 IFNE
44 CPX TEMP2
45 ENDIF
46 IFEQ NO. CURSOR FLASHLIGHT
47 LDY I,CURCOL YES. CURSOR COLOR
48 ELSE
49 LDA BOFLASH NO.
50 IFPL BONUS FLASH
51 TXA YES. BONUS COLOR
52 CLC
53 ADC TEMP3 PLUS BASE COLOR
54 AND I,7 MOD 8
55 CMP I,7
56 IFEQ
57 LDA I,3 NO BLACK
58 ENDIF
59 TAY
60 ELSE
```

```
1 LDY TEMPO NO. USE DEFALT COLOR
2 ENDIF
3 ENDIF
4 ENDIF
5 TYA
6 LDY X,STALOC
7 STA NY,INDYLO
8 DEX
9 MIEND
10 LDX I,NLINES-1 YES. REDO TOP RUNGS
11 BIT WELTYP
12 IFMI
13 DEX PLANAR, SO 1 LESS RUNG
14 ENDIF
15 BEGIN LOOP FOR EACH RUNG
16 LDY I,OCO DEFAULT ON
17 LDA X,SPOKST
18 IFMI PULSAR
19 LDY I,0 YES. TURN OFF
20 ENDIF
21 STY PZL
22 LDY X,RUNLOC
23 LDA NY,RUNGVG
24 AND I,1F
25 ORA PZL
26 STA NY,RUNGVG
27 DEX
28 MIEND
29 RTS
30 OFFSETS INTO WELL SUBROUTINE OF COLOR STATS FOR EACH LINE
31 STALOC .BYTE 0A8,9C,92,86,7C,70,66,5A,50,44,3A,2E,24,18,0E,2,0B2
32 OFFSETS INTO WELL SUBROUTINE +0FE OF COLOR STATS FOR EACH TOP RUNG
33 RUNLOC .BYTE 3B,37,33,2F,2B,27,23,1F,1B,17,13,0F,0B,07,03,3F
34 CHKSM6 .BYTE QCHK6
35 .PAGE
36 .SBTTL DISPLAY-NYMPS
37 IEYL 4
38 DSPNYM
39 LDY I,NYMCOL
40 STY COLOR
41 LDA I,MZCOLO
42 JSR VGSTAT
43 LDX I,XADJL
44 JSR VGYAB1 POSITION BEAM AT VANISH PT.
45 LDA I,18.
46 STA PXL MAX # DISPLAYABLE
47 LDX I,NNYMPH-1
48 STX INDEX1
49 LDY I,0
50 BEGIN LOOP FOR EACH NYMPH
51 LDX INDEX1
52 LDA X,NYMPY
53 IFEQ NYMPH ACTIVE
54 JMP NONYM NO. SKIP IT
55 ENDIF
56 CMP I,50 YES.
57 IFCS SKIP EVERY OTHER ONE PAST THIS DEPTH
58 DEC INDEX1
59 ENDIF
60 PHA
```



1	AND I,3F	FAKE PROJECTION	USE NYMPH DEPTH TO GET SCALES	1
2	STA NY,VGLIST	LINEAR SCALE		2
3	PLA			3
4	ROL			4
5	ROL			5
6	ROL			6
7	AND I,3			7
8	CLC			8
9	ADC I,1			9
10	ORA I,70			10
11	INY			11
12	STA NY,VGLIST	BINARY SCALE		12
13	INY			13
14	LDA X,NYMP	GET NYMPH LINE		14
15	TAX			15
16	LDA X,LIFSXL	VECTOR TO NYMPH		16
17	SEC			17
18	SBC ZADJL			18
19	STA SZL			19
20	STA NY,VGLIST	Z LSB		20
21	INY			21
22	LDA X,LIFSXL			22
23	SBC ZADJL+1			23
24	STA SZH			24
25	AND I,1F			25
26	STA NY,VGLIST	Z MSB		26
27	INY			27
28	LDA X,LIFSXL			28
29	STA SXL			29
30	STA NY,VGLIST	X LSB		30
31	INY			31
32	LDA X,LIFSXL			32
33	STA SXH			33
34	AND I,1F			34
35	STA NY,VGLIST	X MSB		35
36	INY	DISPLAY A DOT		36
37	LDA I,0			37
38	STA NY,VGLIST	0 Z LSB		38
39	INY			39
40	STA NY,VGLIST	0 Z MSB		40
41	INY			41
42	STA NY,VGLIST	0 X LSB		42
43	LDA I,0A0			43
44	INY			44
45	STA NY,VGLIST	BRIGHTNESS, 0 X MSB		45
46	INY			46
47	LDA SZL	DRAW VECTOR BACK TO FAKE V.P.		47
48	EOR I,0FF			48
49	CLC			49
50	ADC I,1			50
51	STA NY,VGLIST	Z LSB		51
52	INY			52
53	LDA SZH			53
54	EOR I,0FF			54
55	ADC I,0			55
56	AND I,1F			56
57	STA NY,VGLIST	Z MSB		57
58	INY			58
59	LDA SXL			59
60	EOR I,0FF			60

```
1 CLC
2 ADC I,1
3 STA NY,VGLIST          X LSB
4
5 INY
6 LDA SXH
7 EOR I,0FF
8
9 ADC I,0
10 AND I,1F
11 STA NY,VGLIST          X MSB
12
13 INY
14 CPY I,0F0
15 IFCS                   VGLIST LSB INDEX MAXING OUT
16
17 DEY
18 JSR VGADD              YES. UPDATE VGLIST
19 LDY I,0                RESET LSB INDEX
20
21 ENDF
22 DEC PXL                EXIT EARLY IF MAX
23 BMI EXCESS             LIMIT REACHED
24
25 NONYM DEC INDEX1
26 MIEND                  EXIT LOOP AFTER LAST NYMPH
27 EXCESS TYA
28
29 IFNE
30 DEY
31 JSR VGADD              UPDATE VGLIST
32 ENDF
33
34 ZQATLI LDA QT1
35 IFNE
36 LDA WAVEN1
37 CMP I,10.
38 IFCS
39 LDA I,7A
40 STA FRTIMR
41 ENDF
42 ENDF
43 LDA I,1
44 JMP VGSCA1
45
46 VGDOT PHA
47 LDY I,0                DRAW A DOT
48 TYA
49 STA NY,VGLIST
50 INY
51 STA NY,VGLIST
52 INY
53 STA NY,VGLIST
54 INY
55 PLA
56 STA NY,VGLIST
57 LDA I,4                UPDATE DISPLAY POINTER
58 CLC
59 ADC VGLIST
60 STA VGLIST
61 IFCS
62 INC VGLIST+1
63 ENDF
64 RTS
65 .PAGE
66 .SBTTL DISPLAY-CURSOR
67
68 DSPCUR LDA I,CURCOL
69 STA COLOR
```

```
1 LDA CURSY
2 IFNE
3 CMP I,ILINDDY
4 IFCC AT BOTTOM
5 STA PYL NO. DEPTH
6 STA TEMPY
7 LDA CURSL2
8 CMP I,81
9 IFNE DON T DISPLAY BLASTED CURSOR
10 LDY CURSL1 CURSOR S WELL LINE #S
11 LDA CURSPO GET CURSOR POSITION BETWEEN LINES
12 LSR
13 AND I,07
14 CLC
15 ADC I,CNCURS ADD IN BASE PIC #
16 JSR ONELIN DRAW LINE
17 ENDIF
18 ENDIF
19 ENDIF
20 RTS
21 .SBTTL DISPLAY-INVADERS MAINLINE
22 DSPINV
23 LDA CURMOD
24 IFPL CURSOR AT TOP
25 LDX I,NINVAD-1 YES
26 STX INDEX1
27 BEGIN LOOP FOR EACH INVADER
28 LDX INDEX1
29 LDA X,INVAY
30 IFNE ACTIVE
31 STA PYL YES
32 LDA X,INVAC1
33 AND I,INVSEQ GET ANIMATION SEQUENCE
34 LSR
35 LSR
36 LSR
37 STA OBJIND
38 LDA X,INVAC1
39 AND I,INVABI
40 ASL
41 JSR INVPIC DRAW INVADER PIC
42 ENDIF
43 DEC INDEX1
44 MIEND
45 ENDIF
46 RTS
47
48 .SBTTL DISPLAY - INVADERS PICS
49
50 INVPIC TAY INDIRECT JSR TO PIC DRAW ROUTINE
51 LDA Y,INVPIT+1
52 PHA
53 LDA Y,INVPIT
54 PHA
55 RTS
56 INVPIT .WORD FLIPIC-1 FLIPPER
57 .WORD PULPIC-1 PULSAR
58 .WORD TANPIC-1 TANKER
59 .WORD TRAPIC-1 TRALER
60 .WORD FUSPIC-1 FUSE
```

```
1 INVPIE
2 .SBTTL DISPLAY - FLIPPERS
3
4 FLIPIC FLIPPER PIC
5 LDA I,FLICOL
6 STA COLOR
7 LDA X,INVAC1
8 IFPL FLIPPING
9 LDY X,INVAL1 LINE #
10 LDX OBJIND
11 LDA X,FLITAB
12 JSR ONELIN NO. ON LINES
13 ELSE
14 JSR IJMPDS YES. SET UP SPECIAL COORDS
15 LDY I,CINVA1
16 JSR ONELN2 FLIPPING PIC
17 ENDIF
18 RTS
19 ANIMATION SEQUENCE
20 FLITAB .BYTE CINVA1,CINVA1,CINVA1,CINVA1
21 .SBTTL DISPLAY - TANKERS
22
23 TANPIC
24 LDA X,INVAC2
25 AND I,INVCAR
26 TAY INDEX FOR TYPE CARRIED
27 LDA Y,TANTAB
28 LDY X,INVAL1
29 JMP SCAPIC DRAW TANKER PIC
30 ANIMATION SEQUENCE
31 TANTAB .BYTE PTTANK,PTTANK,PTTANP,PTTANF
32 .SBTTL DISPLAY - INVADERS DRAW TRAILER
33
34 TRAPIC
35 LDY X,INVAL1
36 LDA QFRAME CHOOSE BETWEEN 4 PICS
37 AND I,3
38 ASL
39 CLC
40 ADC I,PTSPI1
41 JMP SCAPIC DRAW TRALER PIC
42
43 TRATAB .BYTE PTSPI1,PTSPI1+2
44 .BYTE PTSPI1+4,PTSPI1+6
45 .SBTTL DISPLAY-INVADERS DRAW JUMP INVADER
46 IJMPDS
47 LDA PYL SAME Y FOR BOTH PTS.
48 STA TEMPY
49 LDY X,INVAL1
50 LDA Y,LINEX X AND Z FOR BASE LEG
51 STA PXL
52 LDA Y,LINEZ
53 STA PZL
54 LDA X,INVAL2
55 AND I,0F
56 TAY
57 LDA PXL CALCULATE COORD OF JUMPING ENDPT
58 EOR I,80
59 CLC
60 ADC Y,JUMPX
```

```
1 IFVS OVERFLOW
2 IFMI YES
3 LDA I,7F MIN
4 ELSE
5 LDA I,80 MAX
6 ENDIF
7 ENDIF
8 EOR I,80
9 STA TEMPX
10 LDA PZL
11 EOR I,80
12 CLC
13 ADC Y,JUMPZ
14 IFVS OVERFLOW
15 IFMI YES.
16 LDA I,7F
17 ELSE
18 LDA I,80 MAX
19 ENDIF
20 ENDIF
21 EOR I,80
22 STA TEMPZ
23 LDY WELLID
24 LDA Y,WELLIS LINEAR SCALE
25 STA LINSCL
26 LDA Y,WELBIN BINARY SCALE
27 STA BINSCL SET UP DOWN SCALE APPROX 1/8
28 RTS
29 .SBTTL TABLE-WORLD COORD OFFSETS X,Z FOR JUMPERS
30 DG000 2C
31 DG225 28
32 DG450 1F
33 DG675 10
34 DG900 0
35 JUMPZ .BYTE DG900
36 .BYTE DG675
37 .BYTE DG450
38 .BYTE DG225
39 JUMPX .BYTE DG000
40 .BYTE DG225
41 .BYTE DG450
42 .BYTE DG675
43 .BYTE DG900
44 .BYTE-DG675
45 .BYTE-DG450
46 .BYTE-DG225
47 .BYTE-DG000
48 .BYTE-DG225
49 .BYTE-DG450
50 .BYTE-DG675
51 .BYTE DG900
52 .BYTE DG675
53 .BYTE DG450
54 .BYTE DG225
55 .PAGE
56
57 .SBTTL DISPLAY-INVADE FUSE PICTURE
58
59 FUSPIC LDA X,INVAY
60 STA PYL
```

```
1 LDY X,INVAL1
2 LDA Y,LINEX
3 STA PXL
4 LDA Y,LINEZ
5 STA PZL
6 LDA X,INVAL2
7 M10 IFMI RUNGING
8 TYA YES.
9 CLC
10 ADC I,1
11 AND I,0F
12 TAY
13 LDA Y,LINEX
14 SEC
15 SBC PXL
16 JSR DELTA8
17 CLC
18 ADC PXL
19 STA PXL
20 LDA Y,LINEZ
21 SEC
22 SBC PZL
23 JSR DELTA8
24 CLC
25 ADC PZL
26 STA PZL
27 ENDIF
28 JSR WORSCR
29 LDX I,SXL
30 JSR VGYAB1 DRAW BLANK VECTOR TO FUSE
31 LDA I,0
32 STA VGY
33 JSR CASCAL SET PERSPECTIVE SCALE
34 STY VGY
35 LDA QFRAME
36 AND I,3
37 ASL
38 CLC
39 ADC I,PTFUSE
40 TAY
41 LDX Y,PICHI
42 LDA Y,PICLO
43 LDY VGY
44 JMP VGADD3 ADD PIC TO DISPLAY LIST
45 INPUT ACC DELTA BETWEEN LINES
46 X INVADER INDEX
47 Y LINE INDEX OF CCW PT
48 DELTA8 OUTPUT X,Y PRESERVED
49 ACC OFFSET FROM BASE FOR MIDPT
50 STA TEMPO
51 LDA X,INVAL2
52 AND I,7
53 STA TEMP3
54 STX TEMP2
55 LDX I,2
56 LDA I,0
57 BEGIN
58 LSR TEMP3
59 IFCS
60 CLC
```



```
1  ADC TEMPO
2  ENDIF
3  ASL
4  PHP
5  ROR
6  PLP
7  ROR
8  DEX
9  MIEND
10 LDX TEMP2
11 RTS
12 .PAGE
13 .SBTTL  DISPLAY-PULSAR PIC
14
15 PULPIC
16 LDA I,TURQOI          PULSE OFF
17 LDY PULSON
18 IFPL
19 LDA I,WHITE          PULSE ON
20 ENDIF
21 STA COLOR            PULSAR COLOR
22 LDA PULSON           CALCULATE PIC #
23 CLC
24 ADC I,64.
25 LSR
26 LSR
27 LSR
28 LSR
29 CMP I,5
30 IFCS
31 LDA I,0
32 ENDIF
33 TAY
34 LDA Y,PULTAB
35 STA TEMPO
36 LDA X,INVAC1
37 IFPL                FLIPPING
38 LDY X,INVAL1        NO. ON LINES
39 LDA TEMPO           GET PIC #
40 JSR ONELIN          DRAW PIC
41 ELSE
42 JSR IJMPDS          YES. SET UP SPECIAL COORDS
43 LDY TEMPO
44 JSR ONELN2          FLIPPING PIC
45 ENDIF
46 RTS
47 PULTAB .BYTE CPULS0,CPULS1,CPULS2,CPULS3,CPULS4,CPULS4
48 .PAGE
49 .SBTTL  DISPLAY-CHARGES
50 DSPCHG
51 LDX I,NCHARG-1
52 STX INDEX1
53 BEGIN                LOOP FOR EACH CHARGE
54 LDX INDEX1
55 LDA X,CHARY
56 IFNE                ACTIVE
57 STA PYL              YES. BOTH YS ARE SAME
58 STA TEMPY
59 CPX I,NPCHAR
60 LDY X,CHARL1
```

```
1 IFCC
2 LDA I,PTCURS          PLAYER SHOT
3 ELSE
4 LDA QFRAME            ENEMY SHOT
5 ASL
6 AND I,6
7 CLC
8 ADC I,PTESHO
9 ENDIF
10 JSR SCAPIC
11 ENDIF
12 DEC INDEX1
13 MIEND
14 LDY I,ZYELLO          PLENTY
15 LDA CHACOU
16 CMP I,NPCHARG-2
17 IFCS
18 LDY I,ZBLUE           LOW
19 CMP I,NPCHARG
20 IFCS
21 LDY I,ZRED            OUT
22 ENDIF
23 ENDIF
24 STY COLPOR+PSHCTR      SET UP COLOR FOR CENTER OF PLAYER SOT
25 RTS
26 .PAGE
27 .SBTTL  DISPLAY-EXPLOSIONS
28
29 DSPEXP
30 LDY I,EXPCOL
31 STY COLOR
32 LDX I,NEXPLO-1
33 STX INDEX1
34 BEGIN                  LOOP FOR EACH BANG
35 LDX INDEX1
36 LDA X,EXPLOY
37 IFNE                   ACTIVE BANG
38 STA PYL                YES SAVE DEPTH
39 LDA X,EXPLOL           SET UP GRID LINES
40 STA TEMPO
41 LDY X,EXPLOT           CALC. PICTURE TO USE
42 CPY I,1
43 IFEQ                   CHARGE-PLAYER
44 JSR CHPLKI             YES.
45 ELSE                   NO
46 LDA X,EXPLOS
47 LSR
48 AND I,0FE
49 CPY I,2
50 IFCS
51 LDA I,0                NO SEQUENCE TYPE
52 ENDIF
53 CLC
54 ADC Y,TEXTYP
55 LDY TEMPO
56 JSR SCAPIC             DO EXPLOSION PICTURE
57 ENDIF
58 ENDIF
59 DEC INDEX1
60 MIEND
```

```
1 ZQPOKS          LDA QT4
2                IFNE          POKEY DOESN T STOP
3                LDA CURWAV
4                CMP I,13.
5                IFCS
6                STA 1FF          KILL TOP OF STACK
7                ENDIF
8                ENDIF
9                RTS
10 TEXTYP          START CODE FOR EACH BANG TYPE
11                .BYTE PTEXP1      CHARGE CHARGE, CHARGE INVADER
12                .BYTE 0          CHARGE-PLAYER SEE SPECIAL
13                .BYTE PTFUSX+4    BUSE EXPL 1
14                .BYTE PTFUSX+2    FUSE EXPL 2
15                .BYTE PTFUSX+0    FUSE EXPLOSION 3
16                .BYTE PTSPAR      INVADER - PLAYER COLLISION
17                .PAGE
18                .PAGE
19                .SBTTL SPECIAL EXPLOSION CONTROL
20
21 CHPLKI
22                LDY TEMPO
23                LDA Y,LINEXM      SET UP MID PT
24                STA PXL
25                LDA Y,LINEZM
26                STA PZL
27                JSR WORSCR        POSITION BEAM FOR EXPLOSION
28                LDX I,SXL
29                JSR VGYAB1
30                LDX SPXIND
31                DEC SPFTIM
32                IFEQ          UPDATE FRAME TIMER. DONE
33                INX          YES. NEXT PICTURE
34                STX SPXIND
35                LDA X,TSPTIM
36                STA SPFTIM
37                ENDIF
38                LDY X,TSPCOD
39                IFPL          SPECIAL ROUTINE THIS FRAME
40                JSR SPECIAL      YES. DO IT
41                ENDIF
42                LDA SPXIND
43                ASL
44                CLC
45                ADC I,PTSPLA      GET OFFSET INTO TABLE
46                TAY
47                LDX Y,PICHI
48                LDA Y,PICLO
49                JMP VGADD2        MOVE JSRL TO PICTURE TO DISPLAY LIST
50                .PAGE
51                .SBTTL SPECIAL EXPLOSION DATABASE
52
53
54                # OF FRAME/PICTURE
55
56 TSPTIM          .BYTE 2          SPLAT6 CHARGE PLAYER EXPLOSION START
57                .BYTE 2          SLAT5
58                .BYTE 2          SPLAT4
59                .BYTE 2          SPLAT3
60                .BYTE 2          SPLAT2
```

1	.BYTE 4	SPLAT1	1
2	.BYTE 3	SPLAT3	2
3	.BYTE 2	SPLAT5	3
4	PPSTART .BYTE 1	SPLAT6 CHARGE PLAYER EXPLOSION FINISH START PULSAR	4
5	.BYTE 20		5
6	FPSTART .BYTE 3	FUSE PLAYER PICS	6
7	.BYTE 3		7
8	.BYTE 3		8
9	.BYTE 3		9
10	.BYTE 3		10
11	.BYTE 3		11
12	.BYTE 3		12
13	.	SHRAP	13
14			14
15		SPECIAL SUBROUTINE FOR PICTURE	15
16			16
17	TSPCOD .BYTE 0	SPLAT6-ALTER COLORS	17
18	.BYTE 2	SLAT5-ROTATE SPLAT COLORS	18
19	.BYTE 2	4	19
20	.BYTE 2	3	20
21	.BYTE 2	2	21
22	.BYTE 2	1	22
23	.BYTE 2	3	23
24	.BYTE 2	5	24
25	.BYTE 4	6 GET SET FOR SHRAPNEL	25
26	.BYTE 6	SHRAP CHANGE SCALE VARIABLE	26
27	.BYTE -1	FUSE PLAYER - JUST PICS	27
28	.BYTE -1		28
29	.BYTE -1		29
30	.BYTE -1		30
31	.BYTE -1		31
32	.BYTE -1		32
33	.BYTE -1		33
34	CPSPXI -1		34
35	PPSPXI PPSTART-TSPTIM-1		35
36	FPSPXI FPSTART-TSPTIM-1		36
37	.PAGE		37
38	.SBTTL SPECIAL EXPLOSION FUNCTION		38
39			39
40	INPUT Y INDEX INTO SUBROUTINE ADDRESS TABLE		40
41			41
42	SPECIAL		42
43	LDA Y,XSUBR+1		43
44	PHA		44
45	LDA Y,XSUBR		45
46	PHA		46
47	RTS		47
48			48
49	XSUBR .WORD ALTCOL-1	ALTER REGULAR COLORS	49
50	.WORD ROTCOL-1	ROTATE EXPLOSION COLORS	50
51	.WORD SETSHR-1	GET SET FOR SHRAPNEL	51
52	.WORD SHRSCA-1	CHANGE SCALE VARIABLE	52
53	.PAGE		53
54	.SBTTL SPECIAL EXPLOSION SUBROUTINE		54
55			55
56		ALTER COLOR	56
57			57
58	ALTCOL		58
59	LDA I,ZRED	SET UP SLAT COLORS	59
60	STA COLPOR+PDIRE		60

```
1 STA COLRAM+PDIREDD
2 LDA I,ZYELLOW
3 STA COLPOR+PDIYEL
4 STA COLRAM+PDIYEL
5 LDA I,ZWHITE
6 STA COLRAM+PDIWHI
7 STA COLPOR+PDIWHI
8 RTS
9
10 ROTATE COLORS FOR PLAYER EXPLOSION
11
12 ROTCOL LDY COLRAM+PDIWHI
13 LDX I,2
14 BEGIN
15 LDA X,COLRAM+PDIWHI
16 PHA
17 STY X,COLRAM+PDIWHI
18 TYA
19 STA X,COLPOR+PDIWHI
20 PLA
21 TAY
22 DEX
23 MIEND
24 RTS
25 SETSHR GET SET FOR SHRAPNEL
26 JSR INICOL RESTORE COLORS
27 LDA I,7F INITIALIZE LINEAR BINARY SCALES
28 STA SPLINE
29 LDA I,4
30 STA SPBINA
31 RTS
32 SHRSCA CHANGE SHRAPNEL SCALE VARIABLE
33 LDA SPLINE
34 STA SCALE LINEAR SCALE
35 LDA SPBINA
36 ORA I,70 SCALE OPCODE
37 STA SCALE+1 BINARY SCALE
38 LDA I,0C0 RTSL
39 STA SCALE+3
40 LDA SPLINE UPDATE SCALE BIGGER
41 SEC
42 SBC I,20
43 IFMI LINEAR OVERLFLOW
44 AND I,7F YES.
45 DEC SPBINA UPDATE BINARY
46 ENDIF
47 STA SPLINE
48 RTS
49
50 .SBTTL DISPLAY BIG BOOM
51 DSBOOM
52 LAH KILLER+1
53 LXL KILLER
54 JSR VGJSRL KILL BEAM KILLER
55 LDA I,0 CLEAR CURRENT SCREEN POSITION
56 STA CURNTX
57 STA CURNTX+1
58 STA CURNTY
59 STA CURNTY+1
60 STA CURSY
```

```
1 STA ZADJL
2 STA ZADJL+1
3 LDA I,0EO
4 STA EYL
5 LDA I,OFF
6 STA EYH
7 JSR WHICHB
8 STA SVGLIST+1
9 STX SVGLIST
10 SET UP SUBROUTINE PC
11 LDX I,NPARTI-1
12 STX INDEX1
13 BEGIN LOOP FOR EACH PARTICLE
14 LDX INDEX1
15 LDA X,PARTIY
16 IFNE ACTIVE PARTICLE
17 STA PYL
18 LDA X,PARTIX
19 STA PXL
20 LDA X,PARTIZ
21 STA PZL
22 JSR WORSCR PROJECT PT.
23 LDA I,0
24 STA VGBRIT
25 JSR SWAPVG SWAP POINTERS TO VG MAINLINE SUBROUTINE
26 JSR CONNEC DRAW VECTOR IN SUBROUTINE
27 LDA I,0AO
28 JSR VGDOT DRAW DOT IN SUBROUTINE
29 JSR SWAPVG SWAP MAINLINE TO VG PTRS.
30 LDX I,SXL
31 JSR VGYABS
32 JSR CALMAG CALCULATE MAGNIF FACTOR
33 JSR VGSCAL Y LINEAR ACC BINARY PLACE INTO MAINLINE
34 LDA INDEX1
35 AND I,7
36 CMP I,7
37 IFEQ
38 LDA I,0
39 ENDIF
40 TAY
41 STY COLOR
42 LDA I,MZCOLO
43 JSR VGSTAT PLACE INTO MAINLINE
44 LDA I,MZBRIT
45 JSR VGSTA1 SET INTENSITY
46 JSR WHICHB
47 JSR VGJSRL PLACE JSRL TO SUBROUTINE INTO MAINLINE
48 ENDIF
49 DEC INDEX1
50 MIEND
51 JSR SWAPVG SWAP MAINLINE SUBROUTINE PTRS.
52 LDA I,1 AT END OF SUBROUTINE
53 JSR VGSCA1 RESTORE SCALE
54 JSR VGRSL
55 SWAPVG LDX VGLIST SWAP MAINLINE SUBROUTINE PTRS.
56 LDY VGLIST+1
57 LDA SVGLIST
58 STA VGLIST
59 STX SVGLIST
60 LDA SVGLIST+1
```



```
1 STA VGLIST+1
2 STY SVGLIST+1
3 RTS
4
5 CALMAG
6 LDA PYL
7 LSR
8 LSR
9 LSR
10 LSR
11 LDY I,0
12 BEGIN
13 INY
14 LSR
15 EQEND
16 CLC
17 ADC I,2
18 LDY I,0
19 RTS
20 WHICHB
21 LDA BUFACT+BCINFO
22 IFNE
23 LDA BFASTA+1
24 LDX BFASTA
25 ELSE
26 LDA BFBSTA+1
27 LDX BFBSTA
28 ENDIF
29 RTS
30
31 .SBTTL TABLES-WELL COORDINATES WORLD
32 DG0 70+80
33 DG225 67+80
34 DG450 4F+80
35 DG675 2A+80
36 DG900 0+80
37 NEWLIX .BYTE DG0,DG225,DG450,DG675,DG900 CIRCLE
38 .BYTE -DG675,-DG450,-DG225,-DG0
39 .BYTE -DG225,-DG450,-DG675
40 .BYTE DG900,DG675,DG450
41 LCIRCL .BYTE DG225
42 DIO 0F0
43 DI1 0B8
44 DI2 80
45 DI3 48
46 DI4 10
47 .BYTE DIO,DIO,DIO,DI1 SQUARE
48 .BYTE DI2,DI3,DI4,DI4
49 .BYTE DI4,DI4,DI4,DI3
50 .BYTE DI2,DI1,DIO
51 LDIAMO .BYTE DIO
52 CR0 70+80
53 CR1 70+80
54 CR2 38+80
55 CR3 38+80
56 CR4 0+80
57 .BYTE CR0,CR1,CR2,CR3,CR4 CROSS
58 .BYTE -CR3,-CR2,-CR1,-CR0
59 .BYTE -CR1,-CR2,-CR3
60 .BYTE CR4,CR3,CR2
```

```
1 LCROSS .BYTE CR1
2 PX0 6C+80
3 PX1 55+80
4 PX2 31+80
5 PX3 10+80
6 PZ0 14+80
7 PZ1 30+80
8 PZ2 38+80
9 PZ3 27+80
10 .BYTE PX0,PX1,PX2,PX3 PEANUT
11 .BYTE -PX3,-PX2,-PX1,-PX0
12 .BYTE -PX0,-PX1,-PX2,-PX3
13 LPEANU .BYTE PX3,PX2,PX1
14 .BYTE PX0
15 .BYTE 0F0,0C0,0A0,94,6C,60,40,10 4 KEY
16 .BYTE 10,40,60,6C,94,0A0,0C0,0F0
17 .BYTE 0D9,0C2,0AC,97,80,69,52,3C,27,10 TRIANGLE
18 .BYTE 35,5A,80,0A6,0CA,0F0
19 .BYTE 0EA,0E0,9C,80,64,20,16,50 CLOVER
20 .BYTE 16,20,64,80,9C,0E0,0EA,0B0
21 .BYTE 10,1E,2C,3A,48,56,64,70 V
22 .BYTE 90,9E,0AC,0BA,0C8,0D6,0E4,0F0
23 .BYTE 10,1E,2D,3C,4B,5A,69,78,87 PLANE
24 .BYTE 96,0A5,0B4,0C3,0D2,0E1,0F0
25 .BYTE 10,10,10,10,16,29,46,69,97 U
26 .BYTE 0BA,0D7,0EA,0F0,0F0,0F0,0F0
27 .BYTE 10,24,30,36,3E,49,5A,75 JAGGED
28 .BYTE 94,0A4,0AC,0BA,0DA,0E2,0EA,0F0
29
30 .BYTE 80,70,48,20 LYING 8
31 .BYTE 10,20,48,70
32 .BYTE 80,90,0B8,0E0
33 .BYTE 0F0,0E0,0B8,90
34
35 .BYTE 0DA,0A4,87,80,79,5C,26,10 HEART
36 .BYTE 10,20,48,80,0B8,0E0,0F0,0F0
37 .BYTE 10,10,30,30,50,50,70,70 STAIRCASE
38 .BYTE 90,90,0B0,0B0,0D0,0D0,0F0,0F0
39 .BYTE 0B0,80,50,47,18,30,18,47 STAR X
40 .BYTE 50,80,0B0,0B9,0E8,0D4,0E8,0B9
41 .BYTE 10,1E,21,28,3C,55,66,73 WAVE X
42 .BYTE 8D,9A,0AB,0C4,0D8,0DF,0E2,0F0
43 NEWLIZ .BYTE DG900,DG675,DG450,DG225,DG0 CIRCLE
44 .BYTE DG225,DG450,DG675,DG900
45 .BYTE -DG675,-DG450,-DG225,-DG0
46 .BYTE -DG225,-DG450,-DG675
47
48 .BYTE DI2,DI1,DI0,DI0
49 .BYTE DI0,DI0,DI0,DI1
50 .BYTE DI2,DI3,DI4,DI4
51 .BYTE DI4,DI4,DI4,DI3
52 .BYTE CR4,CR3,CR2,CR1,CR0 CROSS
53 .BYTE CR1,CR2,CR3,CR4
54 .BYTE -CR3,-CR2,-CR1,-CR0
55 .BYTE -CR1,-CR2,-CR3
56
57 .BYTE PZ0,PZ1,PZ2,PZ3 PEANUT
58 .BYTE PZ3,PZ2,PZ1,PZ0
59 .BYTE -PZ0,-PZ1,-PZ2,-PZ3
60 .BYTE -PZ3,-PZ2,-PZ1,-PZ0
```

	.BYTE	96,0A3,0C5,0F0,0F0,0C5,0A3,96	4 KEY
	.BYTE	6A,5D,3B,10,10,3B,5D,6A	
	.BYTE	3D,6A,97,0C4,0F0,0C4,97,6A,3D	TRIANGLE
	.BYTE	10,10,10,10,10,10,10	
	.BYTE	0A0,0E0,0EA,0B0,0EA,0E0,0A0,80	CLOVER
	.BYTE	60,20,16,50,16,20,60,80	
	.BYTE	0F0,0D0,0B0,90	V
	.BYTE	70,50,30,10	
	.BYTE	10,30,50,70	
	.BYTE	90,0B0,0D0,0F0	
	.REPT	10 PLANE LOW	
	.BYTE	40	
	.ENDR		
	.BYTE	0F0,0CB,0A6,80,5C,39,20,12	U
	.BYTE	12,20,39,5C,80,0A6,0CB,0F0	
	.BYTE	0C0,0A6,8A,6A,4A,2F,14,24	JAGGED
	.BYTE	20,39,59,75,72,90,0B0,0D0	
	.BYTE	80,57,48,57	BIG 8
	.BYTE	80,0A9,0BA,0A9	
	.BYTE	80,57,48,57	
	.BYTE	80,0A9,0BA,0A9	
	.BYTE	0E4,0E8,0B7,80,0B7,0E8,0E4,0B2	HEART
	.BYTE	7A,47,20,10,20,47,7A,0B2	
	.BYTE	90,70,70,50,50,30,30,10	STAIRCASE
	.BYTE	10,30,30,50,50,70,70,90	
	.BYTE	0E6,0D0,0E6,0B9,0AE,80,52,47	STAR Z
	.BYTE	14,30,14,47,52,80,0AE,0B9	
	.BYTE	7E,6A,51,3A,2C,2C,38,4E	WAVE Z
	.BYTE	4E,38,2C,2C,3A,51,6A,7E	
ILINANG	.BYTE	5,6,7,8,9,10.,11.,12.,13.,14.,15.,0,1,2,3,4	CIRCLE
	.BYTE	4,4,8,8,8,8,0C,0C,0C,0C,0,0,0,0,4,4	SQUARE
	.BYTE	4,8,4,8,8,0C,8,0C,0C,0,0C,0,0,4,0,4	CROSS
	.BYTE	6,7,09,8,7,9,0A,0C,0E,0F,1,0,0F,01,02,4	PEANUT
	.BYTE	7,6,5,8,0B,0A,9,0C,0F,0E,0D,0,3,2,1,4	4 KEY
	.BYTE	5,5,5,5,0B,0B,0B,0B,0B,0,0,0,0,0,0,5	TRIANGLE
	.BYTE	4,8,0B,5,8,0C,0E,9,0C,0,3,0D,0,4,7,2	CLOVER
	.BYTE	0D,0D,0D,0D,0D,0D,0D,0,3,3,3,3,3,3,0	V
	.BYTE	0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0	FLAT
	.BYTE	0C,0C,0C,0D,0E,0F,0F,0,1,1,2,3,4,4,4,0	U
	.BYTE	0E,0D,0C,0D,0D,0D,1,0F,2,3,3,0,3,3,3,0	JAGGED
	.BYTE	0B,9,7,5,3,1,0F,0D,0D,0F,1,3,5,7,9,0B	LYING 8
	.BYTE	8,0B,0C,4,5,8,0B,0C,0D,0E,0F,1,2,3,4,5	HEART
	.BYTE	0C,0,0C,0,0C,0,0C,0,4,0,4,0,4,0,4,0	STAIRCASE
	.BYTE	0A,6,0C,8,0E,0A,0,0C	STAR ANGLES
	.BYTE	2,0E,4,0,6,2,8,4	
	.BYTE	0E,0C,0D,0E,0,2,2,0	WAVE ANGLES
	.BYTE	0E,0E,0,2,3,4,2,0	
OTHER WELL PARAMETERS			
WELSEQ	.BYTE	0,1,2,3,4,5,6,7,0D,9,8,0C,0E,0F,0A,0B	WELL ID SEQUENCE WAVE
WELSEN			
HOLEYL	.BYTE	18,1C,18,0F,18,18,18,18,0A,18,10,0F,18,0C,14,0A	EYE POSITI
HOLEZL	.BYTE	50,50,50,68,50,50,68,0B0,0A0,50,90,80,20,0B0,60,0A0	EYE POSITI
HOLZAD	.BYTE	40,20,40,80,40,40,70,60,0,20,40,0,0A0,40,40,0	CENTER ADJUST
HOLZDH	.BYTE	0FF,0FF,0FF,0FF,0FF,0FF,0FF,0,1,0FF,0,0,0FE,1,0FF,1	

1 HOLRAP .BYTE 0,0,0,0,0,0,0,-1,-1,-1,-1,0,0,-1,0,-1 PLANAR -1 /CLOSED 0 FLAG 1  
2 WELLIS .BYTE 0,0,60,40,0,0,48,40,50,28,50,0,0,50,0,40 LINEAR SCALE FOR JUMPER 2  
3 WELBIN .BYTE 4,4,3,4,4,4,3,4,5,4,4,4,4,4,4,5 BINARY SCALE FOR JUMPER 3  
4 CHKSM7 .BYTE QCHKST 4  
5 .PAGE 5  
6 6  
7 .SBTTL UTILITY - DISPLAY PIC BETWEEN PTS. 7  
8 FUNCTION DISPLAY A PICTURE CENTERED BETWEEN 2 POINTS AND SCALED 8  
9 DOWN ACCORDING TO ITS DEPTH 9  
10 10  
11 11  
12 INPUT X INDEX INTO LINEX,Z OF 1ST PT S X Z WC WORDS 12  
13 Y INDEX INTO LINEX,Z OF 2ND PT S X Z WC WORDS 13  
14 COLOR COLOR OF OBJECT 14  
15 PYL Y WC COORD FOR BOTH PTS. 15  
16 ACC CODE FOR PICTURE TO DISPLAY INDEX INTO PICLO 16  
17 SCAPIC 17  
18 STA OBJIND 18  
19 LDA Y,LINEXM CALCULATE X COORD. OF MIDWAY PT. 19  
20 STA PXL 20  
21 LDA Y,LINEZM CALCULATE Z COORD OF MIDWAYPT. 21  
22 STA PZL 22  
23 23  
24 INPUT PX,Y,Z LOC OF OBJECT 24  
25 OBJIND INDEX INTO PTR. TABLE 25  
26 COLOR COLOR OF OBJECT 26  
27 SCAPI2 27  
28 JSR WORSCR PROJECT MIDWAY PT. ONTO SCREEN. 28  
29 29  
30 LDX I,SXL 30  
31 JSR VGYAB1 DRAW BLANK VECTOR TO MIDWAY PT. 31  
32 LDA I,0 START AT VGLIST 32  
33 STA VGY 33  
34 JSR CASCAL CALCULATE SCALE FOR PT. 34  
35 LDA BFACTR 35  
36 EOR I,7 36  
37 ASL 37  
38 CMP I,0A 38  
39 IFCC 39  
40 LDA I,0A 40  
41 ENDIF 41  
42 ASL 42  
43 ASL 43  
44 ASL 44  
45 STA NY,VGLIST BRIGHTNESS 45  
46 INY 46  
47 LDA I,60 47  
48 STA NY,VGLIST 48  
49 INY 49  
50 STY VGY 50  
51 LDY OBJIND 51  
52 LDX Y,PICHI 52  
53 LDA Y,PICLO 53  
54 LDY VGY 54  
55 JMP VGADD3 DRAW PIC AT PT. 55  
56 RTS 56  
57 .PAGE 57  
58 .SBTTL UTILITY - DERIVE BINARY AND LINEAR SCALE FACTORS GIVEN DEPTH 58  
59 INPUT PYL OBJECT DEPTH EYL,H EYEPOSITION 59  
60 60

```
1  VGY OFFSET INTO VGLIST
2  OUTPUT BFACTR,BINARY TO LINEAR SCALE FACTORS READY FOR VGSCAL
3  ACC BFACTR Y LFACTR
4  CASCAL
5
6
7  LDA PYL          CALCULATE YDELTAS
8  CMP I,10        ***
9  IFCS
10
11 SEC
12 SBC EYL
13 STA MXPL
14
15 LDA I,0
16 SBC EYH
17 STA MXPH          Y DELTA FOR PT TO DISPLAY
18
19 LDA I,18          SET UP MATH BOX TO GIVE FRACTIONAL PORTION
20 STA MNL           OF QUOTIENT IN MYHIGH AND MYLOW
21
22 LDA YDEUNI        ***
23 STA MZLH          Y DELTA FOR SCALE 1
24 STA MSZXD         START DIVIDE Z/X
25
26 BEGIN
27 BIT MSTAT
28 PLEND            EXIT LOOP WHEN DIVIDE IS DONE
29
30 LDA MYLOW         RESULT IS SCALE FACTOR
31 STA SCFL
32 LDA MYHIGH
33 STA SCFL+1
34
35 LDX I,0F          RESTORE MATH BOX QUOTIENT SIZE
36 STX MNL
37 SEC
38 SBC I,1
39 IFEQ
40 LDA I,01
41
42 ENDIF
43 LDX I,0
44 BEGIN
45 INX
46 ASL SCFL
47 ROL
48
49 CSEND
50
51 LSR
52 EOR I,7F
53 CLC
54 ADC I,1
55
56 TAY
57 TXA
58 ELSE
59 LDA I,1           SET MAX SCALE FACTOR 1
60 LDY I,0
61 ENDIF
62 STA BFACTR
63 PHA
64 TYA
65
66 LDY VGY
67 STA NY,VGLIST    LINEAR FACTOR
68 INY
```



```
1 PLA
2 ORA I,70          SCALE OPCODE
3 STA NY,VGLIST     BINARY FACTOR
4 INY               RETURN WITH Y PT TO NEXT VG SLOT
5 RTS
6 .PAGE
7 .SBTTL UTILITY-DRAW OBJECT BETWEEN POINTS
8 INPUT
9 Y INDEX INTO LEXEX,LINEZ OF 2ND POINT S X Z WC COORDS
10
11 ACC INDEX INTO PCOUNT PINDEX, USED TO SET UP INDEX1 AND SUBCOU
12 INDEX1 OFFSET INTO SUBVEC
13 ARRAYS OF 1ST VECTOR PARAMETER OF OBJECT
14 SUBCOU # OF VECTORS TO BE DRAWN
15 PYL, 1ST POINT WC
16 ONELIN
17 STA SAVEY
18 LDA Y,LINEX
19 STA PXL
20 LDA Y,LINEZ
21 STA PZL
22 LDA PYL
23 STA TEMPY
24 TYA
25 CLC               CALCULATE ADJACENT CW LINE #
26 ADC I,1
27 AND I,0F
28 TAX
29 LDA X,LINEX
30 STA TEMPX
31 LDA X,LINEZ
32 STA TEMPZ
33 LDA I,0           SET UP FOR 1,16. SCALE
34 STA LINSCL
35 LDA I,4
36 STA BINSCL
37 LDY SAVEY
38 INPUT Y PIC ID
39 TEMPX,TEMPY,TEMPZ RIGHT PT.WC
40 PXL,PYL,PZL LEFT PT.WC
41 ONELN2           INPUT Y PIC #
42 LDA EYH
43 IFPL             IF LINE WOULD BE BEHIND EYE
44 LDA PYL
45 CMP EYL
46 IFCC
47 RTS             THEN ABORT LINE
48 ENDIF
49 ENDIF
50 LDA Y,PCOUNT
51 STA SUBCOU
52 LDA Y,PINDEX
53 STA INDEX2
54 LDY COLOR
55 LDA I,MZCOLO
56 JSR VGSTAT       SET BEAM COLOR
57 JSR SETINT       SET INTENSITY AS FUNC OF PYL
58 JSR WORSCR       PROJECT 1ST POINT ONTO SCREEN
59 LDX I,SXL
60 JSR VGYAB1       POSITION BEAM AT 1ST POINT
```



1	SAVE SCREEN COORDS OF 1ST POINT	1
2	LDA TEMPX	2
3	STA PXL	3
4	LDA TEMPY	4
5	STA PYL	5
6	LDA TEMPZ	6
7	STA PZL	7
8	JSR WORSCR	8
9	PROJECT 2ND POINT ONTO SCREEN	9
10	CALCULATE + AND - UNIT AND PERPENDICULAR	10
11	UNIT VECTORS FOR THESE 2 POINTS	11
12		12
13	LDY LINSCL	13
14	LDA BINSCL	14
15	JSR VGSCAL	15
16	LDY LINSCL	16
17	LDY LINSCL	17
18	LDY LINSCL	18
19	LDY LINSCL	19
20	LDY LINSCL	20
21	LDY LINSCL	21
22	LDY LINSCL	22
23	LDY LINSCL	23
24	LDY LINSCL	24
25	LDY LINSCL	25
26	LDY LINSCL	26
27	LDY LINSCL	27
28	LDY LINSCL	28
29	LDY LINSCL	29
30	LDY LINSCL	30
31	LDY LINSCL	31
32	LDY LINSCL	32
33	LDY LINSCL	33
34	LDY LINSCL	34
35	LDY LINSCL	35
36	LDY LINSCL	36
37	LDY LINSCL	37
38	LDY LINSCL	38
39	LDY LINSCL	39
40	LDY LINSCL	40
41	LDY LINSCL	41
42	LDY LINSCL	42
43	LDY LINSCL	43
44	LDY LINSCL	44
45	LDY LINSCL	45
46	LDY LINSCL	46
47	LDY LINSCL	47
48	LDY LINSCL	48
49	LDY LINSCL	49
50	LDY LINSCL	50
51	LDY LINSCL	51
52	LDY LINSCL	52
53	LDY LINSCL	53
54	LDY LINSCL	54
55	LDY LINSCL	55
56	LDY LINSCL	56
57	LDY LINSCL	57
58	LDY LINSCL	58
59	LDY LINSCL	59
60	LDY LINSCL	60

1	CLC			1
2	ADC I,1			2
3	ENDIF			3
4	STA Z1L			4
5	ENDIF			5
6	LDA I,0			6
7	STA X2H			7
8	STA Z2H			8
9	90 CYCLES FOR X	CALCULATE UNITXL X 0 THRU 7		9
10	LDA X1L			10
11	ASL			11
12	ROL X2H	X2		12
13	STA X2L			13
14	ASL			14
15	STA X4L	X4		15
16	LDA X2H			16
17	ROL			17
18	STA X4H			18
19	LDA X4L			19
20	CLC			20
21	ADC X1L			21
22	STA X5L	X5		22
23	LDA X4H			23
24	ADC I,0			24
25	STA X5H			25
26	LDA X2L			26
27	CLC			27
28	ADC X1L			28
29	STA X3L	X3		29
30	LDA X2H			30
31	ADC I,0			31
32	STA X3H			32
33	STA X6H	X6		33
34	LDA X3L			34
35	ASL			35
36	STA X6L			36
37	ROL X6H			37
38	CLC			38
39	ADC X1L			39
40	STA X7L	X7		40
41	LDA X6H			41
42	ADC I,0			42
43	STA X7H			43
44		90 CYCLES FOR Z		44
45		CALCULATE UNITZL X 0 THRU 7		45
46	LDA Z1L			46
47	ASL			47
48	ROL Z2H			48
49	STA Z2L	X2		49
50	ASL			50
51	STA Z4L			51
52	LDA Z2H			52
53	ROL			53
54	STA Z4H	X4		54
55	LDA Z4L			55
56	CLC			56
57	ADC Z1L			57
58	STA Z5L	X5		58
59	LDA Z4H			59
60	ADC I,0			60

1	STA Z5H		1
2	LDA Z2L		2
3	CLC		3
4	ADC Z1L		4
5	STA Z3L	X3	5
6	LDA Z2H		6
7	ADC I,0		7
8	STA Z3H		8
9	STA Z6H	X6	9
10	LDA Z3L		10
11	ASL		11
12	STA Z6L		12
13	ROL Z6H		13
14	CLC		14
15	ADC Z1L		15
16	STA Z7L	X7	16
17	LDA Z6H		17
18	ADC I,0		18
19	STA Z7H		19
20	LDY I,0		20
21	STY VGY		21
22	BEGIN	LOOP FOR EACH VECTOR TO BE DRAWN	22
23	LDY INDEX2		23
24	LDA Y,VBASE+1		24
25	CMP I,1		25
26	IFEQ	USE DEPTH INTENSITY	26
27	LDA I,RATS	YES.	27
28	ENDIF		28
29	STA VGBRIT		29
30	LDA Y,VBASE	GET MULTIPLIER S	30
31	STA TEMP4	SIGN FOR PERP. UNIT VECTOR MULT.	31
32	INY		32
33	INY		33
34	STY INDEX2		34
35	TAX		35
36	AND I,07	GET UNIT VECTOR MULTIPLIER	36
37	TAY	ABS. VALUE	37
38	TXA		38
39	ASL		39
40	STA TEMP2	SIGN FOR UNIT VEC MULT	40
41	LSR		41
42	LSR		42
43	LSR		43
44	LSR		44
45	AND I,07	GET PERP UNIT VECTOR MULTIPLIER	45
46	TAX	ABSOLUTE VALUE	46
47	LDA TEMP2		47
48	EOR UNITXH		48
49	IFPL	ACC TO SIGNS, UPDATE VECTOR ACCUMULATOR	49
50	LDA Y,X0L	POSITIVE RESULTS	50
51	STA SXL		51
52	LDA Y,X0H		52
53	ELSE		53
54	LDA Y,X0L	NEGATIVE RESULTS	54
55	EOR I,0FF		55
56	CLC		56
57	ADC I,1		57
58	STA SXL		58
59	LDA Y,X0H		59
60	EOR I,0FF		60

```
1  ADC I,0
2  ENDIF
3  STA SXH
4  LDA TEMP4
5  EOR UNITZH
6  IFMI                      ACC. TO SIGNS UPDATE VECTOR ACCUMULATOR
7  LDA X,Z0L                POSITIVE RESULTS
8  CLC
9  ADC SXL
10 STA SXL
11 LDA X,Z0H
12 ADC SXH
13 ELSE
14 LDA SXL                  NEGATIVE RESULTS
15 SEC
16 SBC X,Z0L
17 STA SXL
18 LDA SXH
19 SBC X,Z0H
20 ENDIF
21 STA SXH
22
23                      NOW CALCULATE Z VECTOR
24
25 LDA TEMP2
26 EOR UNITZH
27 IFPL
28 LDA Y,Z0L
29 STA SZL
30 LDA Y,Z0H
31 ELSE
32 LDA Y,Z0L
33 EOR I,0FF
34 CLC
35 ADC I,1
36 STA SZL
37 LDA Y,Z0H
38 EOR I,0FF
39 ADC I,0
40 ENDIF
41 STA SZH
42 LDA TEMP4
43 EOR UNITXH
44 IFMI
45 LDA SZL
46 SEC
47 SBC X,X0L
48 STA SZL
49 LDA SZH
50 SBC X,X0H
51 ELSE
52 LDA SZL
53 CLC
54 ADC X,X0L
55 STA SZL
56 LDA SZH
57 ADC X,X0H
58 ENDIF
59 STA SZH
60 LDY VGY                ADD VECTOR TO DISPLAY LIST
```

```
1 LDA SZL
2 STA NY,VGLIST          Z LSB
3 INY
4 LDA SZH
5 AND I,1F
6 STA NY,VGLIST          Z MSB
7 INY
8 LDA SXL
9 STA NY,VGLIST          X LSB
10 INY
11 LDA SXH
12 AND I,1F
13 ORA VGBRIT
14 STA NY,VGLIST          X MSB AND INTENSITY
15 INY
16 STY VGY
17 DEC SUBCOU
18 EQEND
19 LDY VGY
20 DEY
21 JMP VGADD              UPDATE VGLIST PC
22 C8 .BYTE 8
23 .PAGE
24 .SBTTL PICTURES
25 CINVA1 0
26 CNCURS CINVA1+1
27 CPULS4 CNCURS+8
28 CPULS3 CPULS4+1
29 CPULS2 CPULS3+1
30 CPULS1 CPULS2+1
31 CPULS0 CPULS1+1
32 PCOUNT
33 .BYTE INVA1E-INVA1S /2 INVADER 1
34 .BYTE NCRS1E-NCRS1S /2
35 .BYTE NCRS2E-NCRS2S /2
36 .BYTE NCRS3E-NCRS3S /2
37 .BYTE NCRS4E-NCRS4S /2
38 .BYTE NCRS5E-NCRS5S /2
39 .BYTE NCRS6E-NCRS6S /2
40 .BYTE NCRS7E-NCRS7S /2
41 .BYTE NCRS8E-NCRS8S /2
42 .BYTE PULS4E-PULS4S /2
43 .BYTE PULS3E-PULS3S /2
44 .BYTE PULS2E-PULS2S /2
45 .BYTE PULS1E-PULS1S /2
46 .BYTE PULS0E-PULS0S /2
47 .MACRO MINDX ARG
48 .BYTE ARG-VBASE
49 .ENDM
50 PINDEX
51 MINDX INVA1S          INVADER 1
52 MINDX NCRS1S
53 MINDX NCRS2S
54 MINDX NCRS3S
55 MINDX NCRS4S
56 MINDX NCRS5S
57 MINDX NCRS6S
58 MINDX NCRS7S
59 MINDX NCRS8S
```

```
1 MINDX PULS4S
2 MINDX PULS3S
3 MINDX PULS2S
4 MINDX PULS1S
5 MINDX PULS0S
6 BYTE 0 D7 SIGN FOR PERP. UNIT VECTOR MULTIPLIER
7 D6 SIGN FOR UNIT VECTOR MULTIPLIER
8 D5-D3 PERP UNIT VECTOR MULTIPLIER ABS. VALUE
9 D2-D0 UNIT VECTOR MULTIPLIER ABS. VALUE
10 BYTE 1 1 USE DEPTH CUE INTENSITY
11 0 BEAM OFF
12 10 DRAW A DOT
13 10 USE VALUE FOR INTENSITY
14 .MACRO VEC UX,UZ,UI
15 .NARG NUM
16 ...ONF 0
17 .IIF EQ,NUM-3,...ONF UI
18 .IIF EQ,NUM-2,...ONF 1
19 ...PUV UZ
20 ...UV UX
21 ...SPU 0
22 ...SUV 0
23 .IF LT,...PUV
24 ...PUV - ...PUV
25 ...SPU 80
26 .ENDC
27 .IF LT,...UV
28 ...UV - ...UV
29 ...SUV 40
30 .ENDC
31 .BYTE ...SPU ...SUV ...PUV*8 ...UV ,...ONF
32 .ENDM
33 .MACRO DOT,...DX,...DY
34 VEC ...DX,...DY,10
35 .ENDM
36 VBASE
37 CURS4E
38 INVA1S
39 VEC 4,1,1
40 VEC 4,-1,1
41 VEC -2,1
42 VEC 1,1
43 VEC -3,-1
44 VEC -3,1
45 VEC 1,-1
46 VEC -2,-1
47 INVA1E
48 NCRS1S
49 VEC 0,-2
50 VEC 2,-1
51 VEC 3,4
52 VEC -3,-3
53 VEC -1,0
54 VEC 0,2
55 VEC 2,1
56 VEC -3,-1
57 NCRS1E
58 NCRS2S
59 VEC 1,-2
60 VEC 7,2
```



1	VEC -3,1	1
2	VEC 2,-1	2
3	VEC -6,-1	3
4	VEC 0,1	4
5	VEC 2,1	5
6	VEC -3,-1	6
7	NCRS2E	7
8	NCRS3S	8
9	VEC 2,-2	9
10	VEC 6,2	10
11	VEC -3,1	11
12	VEC 2,-1	12
13	VEC -5,-1	13
14	VEC -1,1	14
15	VEC 2,1	15
16	VEC -3,-1	16
17	NCRS3E	17
18	NCRS4S	18
19	VEC 3,-2	19
20	VEC 5,2	20
21	VEC -3,1	21
22	VEC 2,-1	22
23	VEC -4,-1	23
24	VEC -2,1	24
25	VEC 2,1	25
26	VEC -3,-1	26
27	NCRS4E	27
28	NCRS5S	28
29	VEC 5,-2	29
30	VEC 3,2	30
31	VEC -3,1	31
32	VEC 2,-1	32
33	VEC -2,-1	33
34	VEC -4,1	34
35	VEC 2,1	35
36	VEC -3,-1	36
37	NCRS5E	37
38	NCRS6S	38
39	VEC 6,-2	39
40	VEC 2,2	40
41	VEC -3,1	41
42	VEC 2,-1	42
43	VEC -1,-1	43
44	VEC -5,1	44
45	VEC 2,1	45
46	VEC -3,-1	46
47	NCRS6E	47
48	NCRS7S	48
49	VEC 7,-2	49
50	VEC 1,2	50
51	VEC -3,1	51
52	VEC 2,-1	52
53	VEC 0,-1	53
54	VEC -6,1	54
55	VEC 2,1	55
56	VEC -3,-1	56
57	NCRS7E	57
58	NCRS8S	58
59	VEC 3,1,0	59
60	VEC 3,-4	60

```
1 VEC 2,1
2 VEC 0,2
3 VEC -3,1
4 VEC 2,-1
5 VEC 0,-2
6 VEC -1,0
7 VEC -3,3
8 NCRS8E
9 .MACRO BVEC UUX,UUY
10 VEC UUX,UUY,0E0
11 .ENDM
12 PULS4S
13 VEC 2,-3
14 VEC 1,6
15 VEC 1,-6
16 VEC 1,6
17 VEC 1,-6
18 VEC 2,3
19 PULS4E
20 PULS3S
21 VEC 1,0,0
22 VEC 1,-2
23 VEC 1,4
24 VEC 1,-4
25 VEC 1,4
26 VEC 1,-4
27 VEC 1,2
28 PULS3E
29 PULS2S
30 VEC 1,0,0
31 VEC 1,-1
32 VEC 1,2
33 VEC 1,-2
34 VEC 1,2
35 VEC 1,-2
36 VEC 1,1
37 PULS2E
38 PULS1S
39 VEC 1,0,0
40 VEC 2,-1
41 VEC 2,2
42 VEC 2,-1
43 PULS1E
44 PULS0S VEC 1,0,0
45 VEC 6,0
46 PULS0E
47
48 .PAGE
49 .SBTTL UTILITY PROJECT POINT ONTO SCREEN
50
51 INPUT
52 PXL,PYL,PZL WORLD COORDINATES OF POINT TO PROJECT
53 EXL,EYL WORLD COORDINATES OF EYE EYL HAS AN
54 IMPLIED NEGATIVE SIGN
55
56 OUTPUT SXH,SZH SCREEN COORDINATES OF PROJECTED POINT
57 MTEMPS DESTROYED
58
59 FORMULAE SCREEN X FACTOR/ PY-EY * PX-EX +SXCENT
```

```
1 SCREEN Z FACTOR/ PY-EY * PZ-EZ +SZCENT 1
2
3
4 CALCULATE COMMON FACTOR FACTOR/ PY-EY 5
5
6
7 .IF NE,0 9
8 240 CYCLES MAX. +MATH BOX FOR X. 10
9 CALCULATE DEPTH FACTOR FOR X Z CALCS 11
10 LDX EYEFAC 12
11 LDA PYL 13
12 CLC 14
13 ADC EYL 15
14 IFCS 16
15 ROR 17
16 21
17 DEX 22
18 ENDIF 23
19 STX FACSAV 24
20 PROJECT X 25
21 TAX 26
22 LDA X, INVEXP 27
23 CLC 28
24 ADC FACSAV 29
25 STA EXPON 30
26 UPDATE FINAL EXPONENT WITH INVERSE EXPO 31
27 LDA X, INVERSE 32
28 STA MBL 33
29 LDA PXL 34
30 MULTIPLICAN TO BOX 35
31 CMP EXL 36
32 IFCS 37
33 SEC 38
34 CALCULATE ABS VALUE SIGN FOR DELTA X 39
35 SBC EXL 40
36 LDX I,0 41
37 POSITIVE RESULT 42
38 ELSE 43
39 LDA EXL 44
40 SEC 45
41 SBC PXL 46
42 LDX I,-1 47
43 NEGATIVE RESULT 48
44 ENDIF 49
45 STA MXL 50
46 STX MTEMP+3 51
47 RESULT SIGN 52
48 STA SYM 53
49 LDA PZL 54
50 SEE COMMENTS FOR X PROJECTION 55
51 CMP EZL 56
52 IFCS 57
53 SEC 58
54 SBC EZL 59
55 LDX I,0 60
56 ELSE 61
57 LDA EZL 62
58 SEC 63
59 SBC PZL 64
60 LDX I,-1 65
61 ENDIF 66
62 STA MTEMP+1 67
63 STX MTEMP+2 68
64 BEGIN 69
65 BIT MSTAT 70
66 WAIT UNTIL BOX IS DONE 71
67 STA MDYPL 72
68 LDA MYLOW 73
69 GET RESULTS 74
70 75
71 76
72 77
73 78
74 79
75 80
```

```
1 STA SXL
2 LDA MYHIGH
3 STA SXH
4 LDA MTEMP+1
5 STA MXL
6 STA SYM
7 LDA SXH
8 UPDATE RESULTS WITH EXPONENT
9 LDX EXPON
10 IFMI DIVIDE
11 BEGIN YES.
12 LSR
13 ROR SXL
14 INX
15 EQEND
16 ELSE
17 IFNE NO MULTIPLY
18 BEGIN YES
19 ASL SXL
20 ROL
21 IFMI OVERFLOW
22 LDA I,OFF YES. MAX OUT
23 STA SXL
24 LDA I,7F
25 LDX I,1
26 ENDIF
27 DEX
28 EQEND
29 ENDIF
30 ENDIF
31 STA SXL+1
32 LDA MTEMP+3
33 IFMI NEGATE IF -
34 LDA I,0
35 SEC
36 SBC SXL
37 STA SXL
38 LDA I,0
39 SBC SXL+1
40 IFVS
41 LDA I,0
42 STA SXL
43 LDA I,80
44 ENDIF
45 STA SXL+1
46 ENDIF
47 BEGIN
48 BIT MSTAT
49 PLEND WAIT UNTIL BOX IS DONE
50 STA MDYPL
51 LDA MYLOW GET RESULTS
52 STA SZL
53 LDA MYHIGH
54 UPDATE RESULTS WITH EXPONENT
55 LDX EXPON
56 IFMI DIVIDE
57 BEGIN YES.
58 LSR
59 ROR SZL
60 INX
```

```
1 EQEND
2 ELSE
3 IFNE NO MULTIPLY
4 BEGIN YES
5 ASL SZL
6 ROL
7 IFMI OVERFLOW
8 LDA I,OFF YES. MAX OUT
9 STA SZL
10 LDA I,7F
11 LDX I,1
12 ENDIF
13 DEX
14 EQEND
15 ENDIF
16 ENDIF
17 STA SZL+1
18 LDA MTEMP+2
19 IFPL
20 LDA SZL
21 CLC
22 ADC ZADJL
23 STA SZL
24 LDA SZL+1
25 ADC ZADJL+1
26 IFVS
27 LDA I,OFF
28 STA SZL
29 LDA I,7F
30 ENDIF
31 STA SZL+1
32 ELSE
33 LDA ZADJL
34 SEC
35 SBC SZL
36 STA SZL
37 LDA ZADJL+1
38 SBC SZL+1
39 IFVS
40 LDA I,0
41 STA SZL
42 LDA I,80
43 ENDIF
44 STA SZL+1
45 ENDIF
46 RTS
47 .ENDC
48 WORSCR
49 LDA PYL
50 SEC
51 SBC EYL
52 STA MXPL
53 LDA I,0
54 SBC EYH
55 STA MXPH
56 IFMI IS POINT BEHIND EYE
57 LDA I,0 YES. PUT IT AT EYE
58 STA MXPH
59 LDA I,1
60 STA MXPL
```

```
1  ENDIF
2  LDA PZL
3  CMP EZL
4  IFCS
5  SBC EZL
6  LDX I,0
7  ELSE
8  LDA EZL
9  SEC
10 SBC PZL
11 LDX I,-1
12 ENDIF
13 STA MZLH
14 STA MSZXD
15 STX MTEMP+2
16 LDA PXL
17 CMP EXL
18 IFCS
19 SBC EXL
20 LDX I,0
21 ELSE
22 LDA EXL
23 SEC
24 SBC PXL
25 LDX I,-1
26 ENDIF
27 STA MTEMP+1
28 STX MTEMP+3
29 BEGIN
30 BIT MSTAT
31 PLEND
32 LDA MYLOW
33 STA SZL
34 LDA MYHIGH
35 STA SZH
36
37 LDA MTEMP+1
38 STA MZLH
39 STA MSZXD
40 LDA MTEMP+2
41 IFPL
42 LDA SZL
43 CLC
44 ADC ZADJL
45 STA SZL
46 LDA SZL+1
47 ADC ZADJL+1
48 IFVS
49 LDA I,0FF
50 STA SZL
51 LDA I,7F
52 ENDIF
53 STA SZL+1
54 ELSE
55 LDA ZADJL
56 SEC
57 SBC SZL
58 STA SZL
59 LDA ZADJL+1
60 SBC SZL+1
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1	IFVS		1
2	LDA I,0		2
3	STA SZL		3
4	LDA I,80		4
5	ENDIF		5
6	STA SZL+1		6
7	ENDIF		7
8	BEGIN		8
9	BIT MSTAT		9
10	PLEND		10
11	LDA MYLOW		11
12	STA SXL		12
13	LDA MYHIGH		13
14	STA SXH		14
15	LDX MTEMP+3		15
16	IFPL		16
17	LDA SXL		17
18	CLC		18
19	ADC XADJL		19
20	STA SXL		20
21	LDA SXL+1		21
22	ADC XADJL+1		22
23	IFVS		23
24	LDA I,0FF		24
25	STA SXL		25
26	LDA I,7F		26
27	ENDIF		27
28	STA SXL+1		28
29	RTS		29
30	ENDIF		30
31	LDA XADJL		31
32	SEC		32
33	SBC SXL		33
34	STA SXL		34
35	LDA XADJL+1		35
36	SBC SXL+1		36
37	IFVS		37
38	LDA I,0		38
39	STA SXL		39
40	LDA I,80		40
41	ENDIF		41
42	STA SXL+1		42
43	RTS		43
44	.SBTTL INITIALIZE DISPLAY		44
45			45
46	INIDSP JSR INITEM	COPY SCORE TEMPLATE TO VECTOR RAM	46
47	LDA I,80	EYE CENTERED X WISE	47
48	STA EXL		48
49	LDA I,0FF	REG-WELL UPDATE FROM MAINLINE	49
50	STA ROTDIS		50
51	JSR INIWLS	INIT. WELL	51
52	LDA SPARE3		52
53	IFEQ	VG HALT AS REQUESTED	53
54	STA VGSTOP	NO. STOP IT	54
55	ENDIF		55
56	LDA I,0		56
57	STA SPARE3		57
58	LDA JMPMAL+4	REQUEST HALT	58
59	STA VECRAM		59
60	LDA JMPMAH+4		60

1	STA VECRAM+1		1
2	INICOL LDA CURWAV		2
3	AND I,70		3
4	CMP I,5F		4
5	IFCS		5
6	LDA I,5F		6
7	ENDIF		7
8	LSR		8
9	ORA I,07	COLOR TABLE INDEX	9
10	TAX		10
11	LDY I,07		11
12	BEGIN	SET UP COLOR RAM	12
13	LDA X,COLTAB		13
14	AND I,0F		14
15	STA Y,COLRAM		15
16	STA Y,COLPORT		16
17	LDA X,COLTAB		17
18	LSR		18
19	LSR		19
20	LSR		20
21	STA Y,COLRAM+8		21
22	STA Y,COLPORT+8		22
23	DEX		23
24	DEY		24
25	MIEND		25
26	RTS		26
27			27
28	INIMAT		28
29	LDA I,0	INITIALIZE FOR ONELIN	29
30	STA X1H		30
31	STA Z1H		31
32	STA X0H		32
33	STA X0L		33
34	STA Z0H		34
35	STA Z0L		35
36	LDA I,0	ZERO UNUSED MATH BOX REGISTERS	36
37	STA MAL		37
38	STA MAH		38
39	STA MEL		39
40	STA MEH		40
41	STA MFL		41
42	STA MFH		42
43	STA MXH		43
44	STA MBH		44
45	STA MZLL		45
46	STA MZLH		46
47	STA MZHL		47
48	STA MZHH		48
49	LDA I,0F		49
50	STA MNL		50
51	RTS		51
52	.PAGE		52
53	.SBTTL COLORS		53
54	COLTAB		54
55	.BYTE ZWHITE	1 EXPLOSIONS 0 PLAYER SHOT CENTER 8	55
56	.BYTE ZYELLO	CURSOR, FLASHLIGHT 1 SPLAT A	56
57	.BYTE ZPURPL	TANKERS 2 SPLAT B	57
58	.BYTE ZRED	FLIPPERS 3 SPLAT C	58
59	.BYTE ZTURQOI ZRED*10	PULSARS 4 NYMPHS 0D	59
60	.BYTE ZGREEN	LETTERS S	60

1	.BYTE ZBLUE	WELL 6	1
2	.BYTE ZBLUE	LETTERS 7 FLASH OF	2
3	.BYTE ZWHITE	2	3
4	.BYTE ZGREEN		4
5	.BYTE ZBLUE		5
6	.BYTE ZPURPL		6
7	.BYTE ZYELLOW ZYELLOW*10		7
8	.BYTE ZTURQOI		8
9	.BYTE ZRED		9
10	.BYTE ZRED		10
11	.BYTE ZWHITE	3	11
12	.BYTE ZBLUE		12
13	.BYTE ZTURQOI		13
14	.BYTE ZGREEN		14
15	.BYTE ZPURPL ZRED*10		15
16	.BYTE ZRED		16
17	.BYTE ZYELLO		17
18	.BYTE ZYELLOW		18
19	.BYTE ZWHITE	4	19
20	.BYTE ZBLUE		20
21	.BYTE ZPURPL		21
22	.BYTE ZGREEN		22
23	.BYTE ZYELLO ZRED*10		23
24	.BYTE ZRED		24
25	.BYTE ZTURQOI		25
26	.BYTE ZTURQOI		26
27			27
28			28
29			29
30	.BYTE ZWHITE	5	30
31	.BYTE ZYELLO		31
32	.BYTE ZPURPL		32
33	.BYTE ZRED		33
34	.BYTE ZTURQOI ZRED*10		34
35	.BYTE ZGREEN		35
36	.BYTE ZBLACK		36
37	.BYTE ZBLUE		37
38	.BYTE ZWHITE	6	38
39	.BYTE ZRED		39
40	.BYTE ZPURPL		40
41	.BYTE ZYELLOW		41
42	.BYTE ZTURQOI ZRED*10		42
43	.BYTE ZBLUE		43
44	.BYTE ZGREEN		44
45	.BYTE ZGREEN		45
46	SPWECO .BYTE BLUE,RED,YELLOW,TURQOI,WHITE,GREEN,GREEN,GREEN	SPECIAL WE	46
47	.PAGE		47
48	.SBTTL INITIALIZE-GRID LINES		48
49	INPUT Y INDEX INTO NEW LIX,Z OF LAST GRID LINE S COORDINATES		49
50	.PAGE		50
51	.SBTTL INITIALIZE WELL		51
52			52
53	INIWLS		53
54	LDX PLAYUP		54
55	LDA X,WAVEN1		55
56	JSR LVLWEL		56
57	PHA	CONVERT CODE TO INDEX	57
58	LDY WELLID		58
59	LDA Y,HOLEYL	EYE POSITION Y	59
60	EOR I,OFF	CONVERT+TABLE VALUE TO NEG.	60

```
1 CLC
2 ADC I,1
3 STA EYL
4 STA EYLDES
5 LDA I,10
6 SEC
7 SBC EYL DELTA FOR UNIT SCALE
8 STA YDEUNI
9 LDA I,-1
10 STA EYH
11 LDA Y,HOLEZL EYE POSITION Z
12 STA EZL
13 LDA Y,HOLRAP WELL TYPE OPEN I CLOSED
14 STA WELTYP
15 LDA QNXTST
16 CMP I,CNWLF2
17 IFEQ
18 LDA Y,HOLZAD AT CENTER IMMEDIATELY NEW LIFE
19 STA ZADJL
20 LDA Y,HOLZDH
21 STA ZADJL+1
22 ELSE
23 LDA Y,HOLZAD MOVE UP SLOWLY NEW WAVE
24 SEC
25 SBC ZADJL
26 STA ZADEST
27 LDA Y,HOLZDH
28 SBC A,ZADJL+1
29 LDX I,3
30 BEGIN
31 LSR
32 ROR ZADEST
33 DEX
34 MIEND
35 ENDIF
36 LDA I,0 X SCREEN CENTER
37 STA XADJL
38 STA XADJL+1
39 LDA I,0 SAY TOP BOTTOM ON SCREEN
40 STA LEVELY
41 STA LEVELY+1
42 LDA I, VECRAM+0C00 /100 SET UP SUBR BUFR PC
43 STA ROTFLG
44 PLA
45 TAY
46 LDX I,NLINES-1
47 BEGIN LOOP FOR EACH GRID LINES
48 LDA Y,NEWLIX
49 STA X,LINEX SET UP X AND Z INTEGER PORTIONS
50 LDA Y,NEWLIZ
51 STA X,LINEZ
52 LDA I,0 ZERO FRACTIONAL PORTION
53 STA X,LINSXH
54 STA X,LINSZH
55 STA X,LINSTA
56 LDA Y,ILINANG LINE ANGLE
57 STA X,LINANG
58 DEY
59 DEX
60 MIEND
```

1			1
2			2
3	LDY I,0	CALCULATE MIDPTS	3
4	LDX I,0F		4
5	BEGIN	LOOP FOR EACH LINE	5
6	LDA Y,LINEX		6
7	SEC		7
8	ADC X,LINEX		8
9	ROR		9
10	STA X,LINEXM		10
11	LDA Y,LINEZ		11
12	SEC		12
13	ADC X,LINEZ		13
14	ROR		14
15	STA X,LINEZM		15
16	DEY		16
17	IFMI		17
18	LDY I,0F		18
19	ENDIF		19
20	DEX		20
21	MIEND		21
22	RTS		22
23			23
24	DETERMINE WELL SEQUENCE INDES		24
25	INPUT ACC LEVEL #-1		25
26	OUTPUT ACC INDEX INTO WELL SEQUENCE TABLES		26
27	WELLID WELL ID		27
28	LVLWEL LDX I,0		28
29	CMP I,98.		29
30	IFCS		30
31	LDA RANDOM		31
32	AND I,5F		32
33	ENDIF		33
34	CMP I,WELSEN-WELSEQ		34
35	BEGIN	WAVE # MOD # OF WELLS	35
36	IFCS		36
37	INX		37
38	SEC		38
39	SBC I,WELSEN-WELSEQ		39
40	ENDIF		40
41	CMP I,WELSEN-WELSEQ		41
42	CCEND		42
43	TAY		43
44	LDA Y,WELSEQ	GET WELL CODE FOR THIS WAVE	44
45	STA WELLID		45
46	ASL		46
47	ASL		47
48	ASL		48
49	ASL		49
50	ORA I,0F		50
51	RTS		51
52			52
53	.SBTTL UTILITY-BUILD WELL DISPLAY BUFFER		53
54	BLDWEL		54
55	LDA LEVELY+1		55
56	IFEQ	BOTTOM OF WELL ON SCREEN LAST TIME	56
57	LDA I,ILINDDY	YES	57
58	STA PYL	BOTTOM OF WELL Y	58
59	LDX I,4F	INDEX FOR SCREEN COORDS	59
60	JSR CALOUT	CALCULATE SCREEN COORDS FOR BOTTOM OF WELL	60

1	STA LEVELY+1	OFF SCREEN FLAG	1
2	IFNE	BOTTOM OFF SCREEN	2
3	STA LEVELY	YES. THEN SO IS TOP	3
4	ENDIF		4
5	LDA LEVELY		5
6	IFEQ	TOP OF WELL ON SCREEN LAST TIME	6
7	LDA I,ILINLIY	YES.	7
8	STA PYL	TOP OF WELL Y	8
9	JSR CHKDEP		9
10	LDA PYL		10
11	LDX I,OF	INDEX FOR SCREEN COORDS	11
12	JSR CALOUT	CALCULATE SCREEN COORDS FOR TOP OF WELL	12
13	STA LEVELY	OFF SCREEN FLAG	13
14	ENDIF		14
15	ENDIF		15
16	.SBTTL UTILITY-BUILD WELL PIAC		16
17	WELPIC		17
18	LDA I,1		18
19	JSR VGSCAL	NORMAL SCAL	19
20	LDY I,WELCOL		20
21	STY COLOR		21
22	LDX LEVELY+1		22
23	IFNE	OFF SCREEN	23
24	RTS	YES. ABORT	24
25	ENDIF		25
26	LDX ROTFLG	WELL ON	26
27	IFEQ		27
28	RTS	NO. NO SPOKES	28
29	ENDIF		29
30		ABORT IF ANY OF FAR PTS ARE OFF SCREEN LDX I,NL	30
31	LDX I,NLINES-1		31
32	BEGIN	LOOP FOR ACH SPOKE	32
33	LDA I,RATS	SPOKE INTENSITY	33
34	JSR SPOKE	DRAW SPOKE	34
35	DEX		35
36	MIEND		36
37	.SBTTL DISPLAY-WELL RIM		37
38	LDY I,WELCOL		38
39	STY COLOR		39
40	LDA I,MZCOLO		40
41	JSR VGSTAT		41
42	LDY I,4F		42
43	LDA LEVELY+1		43
44	JSR OUTLIN		44
45	LDY I,OF		45
46	LDA LEVELY		46
47	OUTLIN	DRAW TOP Y 0 OR BOTTOM Y 40 OF WELL	47
48	IFEQ	ON SCREEN	48
49	STY INDEX1	YES	49
50	LDA Y,LINSXL		50
51	STA SXL		51
52	LDA Y,LINSXH		52
53	STA SXH		53
54	LDA Y,LINSZL		54
55	STA SZL		55
56	LDA Y,LINSZH		56
57	STA SZH		57
58	LDX I,SXL		58
59	JSR VGYABS	UPDATE CURNTX,Y	59
60	LDA VGLIST	SAVE FOR RUNG CHANGES	60



```
1 STA RUNGVG
2 LDA VGLIST+1
3 STA RUNGVG+1
4 LDX I,NLINES-1
5 LDA WELTYP
6 IFNE PLANAR
7 DEX YES. BEAM OFF FOR 1ST LINE
8 ENDIF
9 LDA I,RATS
10 STA VGBRIT TURN ON BEAM
11 STX INDEX2
12 BEGIN LOOP FOR EACH LINE ON LEVEL
13 DEC INDEX1
14 LDA INDEX1
15 AND I,0F
16 CMP I,0F
17 IFEQ INDEX WRAPPING
18 LDA INDEX1
19 CLC YES
20 ADC I,10
21 STA INDEX1
22 ENDIF
23 JSR LINTOS MOVE LINS TO SXL...SZH
24 DEC INDEX2
25 MIEND
26 ENDIF
27 RTS
28 .SBTTL UTILITY-CONNECT CURRENT PT. WITH NEXT POINT
29
30 CONNEC DRAW A LINE TO NEXT POINT SX
31 LDA SXL CURRENT POINT CURNTX AND
32 SEC SET CURRENT POINT NEXT POIN
33 SBC CURNTX
34 STA XCOMP
35 LDA SXH
36 SBC CURNTX+1
37 STA XCOMP+1 X PORTION OF VECTOR
38 LDA SZL
39 SEC
40 SBC CURNTY
41 STA YCOMP
42 LDA SZH
43 SBC CURNTY+1
44 STA YCOMP+1 Z PORTION OF VECTOR
45 LDX I,XCOMP
46 UPCURN JSR VGVCTR DRAW VECTOR
47 LDA SXL SET CURRENT PT NEXT PT
48 STA CURNTX
49 LDA SXH
50 STA CURNTX+1
51 LDA SZL
52 STA CURNTY
53 LDA SZH
54 STA CURNTY+1
55 MAKE SURE BEAM IS ON
56 LDA I,RATS
57 STA VGBRIT
58 RTS
59 .SBTTL DISPLAY-DRAW 2 SPOKES
60 INPUT X LINE # TO ILLUMINATE
```

```
1  ACC INTENSITY
2  OUTPUT X PRESERVED
3  SPOKE STX INDEX1
4
5  PHA
6  LDY COLOR
7  LDA I,MZCOLO
8
9  JSR VGSTAT
10
11  JSR LIFTOS
12  CENTER BEAM
13  FAR PT SCREEN COORD
14  LDX I,SXL
15  DRAW BLANK VEC TO FAR PT.
16  JSR VGYABS
17  CURRENT PT. FAR PT.
18  PLA
19
20  STA VGBRIT
21  PHA
22
23  JSR LINTOS
24  NEAR PT COORD
25  DEC INDEX1
26  LDY COLOR
27  LDA I,0
28  STA VGBRIT
29  LDA I,MZCOLO
30  JSR VGSTAT
31  JSR LINTOS
32  DRAW FROM NEAR PT. TO ADJ NEAR PT.
33  PLA
34
35  STA VGBRIT
36  JSR LIFTOS
37  JSR CONNEC
38  DRAW TO FAR PT.
39  LDX INDEX1
40  RTS
41  LINTOS LDX INDEX1
42  LDA X,LINSXL
43  STA SXL
44  LDA X,LINSXH
45  STA SXH
46  LDA X,LINSZL
47  STA SZL
48  LDA X,LINSZH
49  STA SZH
50  JMP CONNEC
51  DRAW LINE
52
53  LIFTOS
54  LDX INDEX1
55  LDA X,LIFSXL
56  STA SXL
57  LDA X,LIFSXH
58  STA SXH
59  LDA X,LIFSZL
60  STA SZL
61  LDA X,LIFSZH
62  STA SZH
63  RTS
64  .PAGE
65
66  .SBTTL CHECK FOR EYE PAST OBJECT ON WELL
67
68  CHKDEP
69
70  LDA EYH
71  IFEQ
72  EYE +
73  LDA PYL
74  YES.
75
76  SEC
77  SBC EYL
78  IFCS
79
80
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```
1  CMP I,0C
2  ENDIF
3  IFCC                                EYE TO CLOSE
4  LDA EYL                            YES. NUDGE PT. AWAY
5  CLC
6  ADC I,0F
7  IFCC
8  CMP I,0F0
9  ENDIF
10 IFCS
11 LDA I,0F0                          BUT NOT PAST END OF WELL
12 ENDIF
13 STA PYL
14 ENDIF
15 ENDIF
16 RTS
17 CHKSM8      .BYTE QCHKS8
18 .PAGE
19 .SBTTL  UTILITY-PROJECT OUTLINE
20 INPUT ACC Y COORDINATE FOR OUTLINE
21      X OF OR 4F FOR NEAR OR FAR ARRAY
22      LINEX,Z 10  OUTLINE S X AND Z COORDINATES
23
24 OUTPUT ACC 0 IF OUTLINE IS ONSCREEN
25      NOT 0 IF ANY PT. IS OFF SCREEN
26
27 CALOUT
28      STA PYL                        SAVE Y FOR OUTLINE
29      STX INDEX2                     SAVE INDEX OF DEST IN ARRAY
30      LDA I,0
31      STA LINSCA                     START OFF SCREEN FLAG AT ON SCREEN
32      LDX I,0F
33      STX INDEX1
34      BEGIN                          LOOP FOR EACH PT. ON OUTLINE
35      LDX INDEX1
36      LDA X,LINEX
37      STA PXL
38      LDA X,LINEZ
39      STA PZL
40      JSR WORSCR                     PROJECT PT.
41      LDX INDEX2
42      LDY SXL
43      LDA SXH
44      IFPL                          X OFF SCREEN
45      CMP I,4
46      IFCS
47      LDY I,0FF
48      LDA I,3
49      INC LINSCA                     YES
50      ENDIF
51      ELSE
52      CMP I,-4
53      IFCC
54      LDY I,1
55      LDA I,-4
56      INC LINSCA                     YES. SET OFF SCREEN FLAG
57      ENDIF
58      ENDIF
59      STA X,LINSXH
60      TYA
```

```
1 STA X,LINSXL
2 LDY SZL
3 LDA SZH
4 IFPL Z OFF SCREEN
5 CMP I,4
6 IFCS
7 LDY I,OFF
8 LDA I,3
9 INC LINSCA YES.
10 ENDIF
11 ELSE
12 CMP I,-4
13 IFCC
14 LDA I,-4
15 LDY I,1
16 INC LINSCA YES
17 ENDIF
18 ENDIF
19 STA X,LINSZH
20 TYA
21 STA X,LINSZL
22 DEC INDEX2
23 DEC INDEX1
24 MIEND
25 LDA LINSCA
26 RTS
27 .PAGE
28 .SBTTL UTILITY-DRAW WELL SHAPE
29 INPUT ACC LEVEL #-1
30
31 DSPHOL
32 JSR LVLWEL SET UP WELL INDEX ID
33 STA SAVEY WELL INDEX
34 STX SAVEX CYCLE
35 LDA I,0
36 STA VGBRIT
37 LDA I,5 MAKE WELL REALLY SMALL
38 JSR VGSCA1
39 LDA SAVEX GET CYCLE TIMES THRU ALL WELLS
40 AND I,7
41 TAX
42 LDY X,SPWECO GET SPECIAL WELL COLOR FOR CYCLE
43 STY COLOR
44 LDA I,MZCOLO
45 JSR VGSTAT SET WELL COLOR
46 LDX WELLID
47 LDA SAVEY
48 LDY X,HOLRAP
49 IFEQ PLANAR
50 SEC NO. START BEAM AT FIRST POINT
51 SBC I,OF IN TABLE FOR CLOSED WELLS
52 ENDIF
53 TAY
54 LDA Y,NEWLIZ
55 STA PYL
56 EOR I,80 ADJUST Z SIGN
57 TAX
58 LDA Y,NEWLIX SAVE COORDS OF 1ST PT
59 STA PXL
60 EOR I,80 ADJUST X SIGN
```

```
1 JSR VGVTR1          POSITION BEAM AT 1ST PT ON WELL
2 LDA I,0C0          TURN BEAM ON
3 STA VGBRIT
4 LDX I,NLINES-1
5 STX INDEX2
6 BEGIN              LOOP FOR EACH PT ON EDGE
7 LDY SAVEY
8 LDA Y,NEWLIX
9 TAX
10 SEC
11 SBC PXL            DELTA X
12 PHA
13 STX PXL            CURRENT X OLD X
14 LDA Y,NEWLIZ
15 TAY
16 SEC
17 SBC PYL            DELTA Z
18 TAX
19 STY PYL            CURRENT Z OLD Z
20 PLA
21 JSR VGVTR1          DRAW VECTOR TO NEXT PT.
22 DEC SAVEY
23 DEC INDEX2
24 MIEND
25 LDA I,1            NORMAL SIZE AGAIN
26 JMP VGSCA1
27 .SBTTL             DISPLAY STAR FIELD
28
29 DSTARF
30 LDA PLAGRO
31 IFNE
32 LDA EYL            SAVE EYE POSITION
33 PHA
34 LDA EYH
35 PHA
36 LDA YDEUNI
37 PHA
38 LDA I,0E8
39 STA EYL
40 LDA I,0FF
41 STA EYH
42 LDA I,28
43 STA YDEUNI
44 .SBTTL             DISPLAY-PLANES OF STARS
45 LDX I,NPLANE-1
46 STX INDEX1
47 BEGIN              LOOP FOR EACH PLANE OF STARS
48 LDX INDEX1
49 LDA X,PLANEY
50 IFNE              ACTIVE PLANE
51 STA PYL            YES
52 LDA I,80            CENTER OF WORLD
53 STA PXL
54 LDA I,80
55 STA PZL
56 LDA CURWAV
57 CMP I,5
58 IFCC
59 LDA I,BLUE          BLUE STARS IN WAVES 1-4
60 ELSE
```

```
1 TXA
2 AND I,7
3 CMP I,7
4 IFEQ
5 LDA I,4
6 ENDIF
7 ENDIF
8 STA COLOR
9 TAY
10 LDA I,MZCOLO
11 JSR VGSTAT
12 LDA INDEX1
13 AND I,3 DETERMINE PICTURE SUBROUTINE CODE
14 ASL
15 ADC I,PTSTR1
16 STA OBJIND
17 JSR SCAP12 DRAW PLANE OF STARS ACC TO SCALE
18 ENDIF
19 DEC INDEX1
20 MIEND
21 PLA
22 STA YDEUNI
23 PLA RESTORE EYE POSITION
24 STA EYH
25 PLA
26 STA EYL
27 ENDIF
28 ZQPONS LDA QT5
29 IFNE
30 LDX LSCORH
31 CPX I,15
32 IFCS
33 LDX LSCORL
34 INC X,200
35 ENDIF
36 ENDIF
37 RTS
38
39 .SBTTL DISPLAY - ENEMY LINES
40
41 DSPENL
42 LDA LEVELY+1 BOTTOM OF WELL
43 IFNE WELL ON
44 RTS NO. NO ENEMY LINES THEN
45 ENDIF
46 LDA EYH
47 IFEQ EYE ON WELL
48 LDA EYL YES.
49 CMP I,0F0
50 IFCS PAST END
51 RTS YES. ABORT
52 ENDIF
53 ENDIF
54 LDA I,1
55 JSR VGSCA1
56 LDA VGLIST SAVE FOR NEXT TIME
57 PHA
58 LDA VGLIST+1
59 PHA
60 LDA I,0 LINE LOOP INDEX
```



```
1 STA INDEX2
2 STA VGY
3 LDX I,NLINES-1
4 LDA WELTYP
5 IFNE PLANAR
6 DEX YES. 1 LESS LINE
7 ENDIF
8 STX INDEX1
9 BEGIN LOOP FOR EACH LINE FROM 0 TO TOP
10 LDX I,3
11 LDY VGY
12 BEGIN SET FIXED CODES
13 LDA X,ENLFIX CSTATGREEN,CNTR
14 STA NY,VGLIST
15 INY
16 DEX
17 MIEND
18 STY VGY
19 LDA ROTDIS
20 IFEQ REDO WELL
21 LDX INDEX2 NO
22 LDA X,LINSTA
23 IFPL ACTION AT NEAR PT
24 LDX I,0B
25 LDY VGY
26 BEGIN NO. COPY VARIABLE STUFF
27 LDA NY,OLDLLO COPY VECTOR TO FAR POINT AND
28 STA NY,VGLIST VECTOR TO NEAR POINT
29 INY
30 DEX
31 MIEND
32 STY VGY
33 ELSE
34 LDY VGY NO. SINCE FAR PT. NEED NOT BE
35 LDA NY,OLDLLO RECALCULATED, COPY IT TO NEW BUFFER.
36 STA NY,VGLIST
37 STA CURNTY Z VECTOR LSB
38 INY
39 LDA NY,OLDLLO
40 STA NY,VGLIST
41 CMP I,10
42 IFCS
43 ORA I,0E0 SIGN EXTEND
44 ENDIF
45 STA CURNTY+1 Z VECTOR MSB
46 INY
47 LDA NY,OLDLLO
48 STA NY,VGLIST X VECTOR LSB
49 STA CURNTX
50 INY
51 LDA NY,OLDLLO
52 STA NY,VGLIST
53 CMP I,10
54 IFCS
55 ORA I,0E0 SIGN EXTEND
56 ENDIF
57 STA CURNTX+1 X VECTOR MSB
58 INY
59 STY VGY
60 JSR TIPACT YES. GENERATE TIP STUFF
```

```
1  ENDIF
2  ELSE
3      YES REDO WELL
4  JSR FIXSTU      GENERATE FIXED STUFF
5  JSR TIPACT      GENERATE TIP STUFF
6  ENDF
7  LDX INDEX2
8  ASL X,LINSTA    CLEAR LINE STATUS
9  INC INDEX2
10 DEC INDEX1
11 MIEND
12 PLA              SAVE LOC OF NEW BUFFER
13 STA OLDLHI
14 PLA
15 STA OLDLLO
16 LDY VGY
17 DEY
18 JMP VGADD        UPDATE VGLIST
19 .SBTTL DISPLAY - ENEMY LINES INITIAL FIXED VG CODES
20
21 PLACES COLOR STAT
22                      CNTR
23                      VCTR TO FAR PT.
24 INTO VGLIST VGY
25 ENLFIX .BYTE 80,40,68,05
26 FIXSTU
27
28 CALCULATE SCREEN LOCATION OF
29 FAR POINT
30
31 LDA INDEX2
32 TAX
33 CLC              AVERAGING SCREEN COORDNATE
34 ADC I,1          OF ADJACENT LINES
35 AND I,0F
36 TAY
37 LDA X,LIFSXL
38 SEC              ROUND
39
40 ADC Y,LIFSXL
41 STA SXL
42 LDA X,LIFSXH
43 ADC Y,LIFSXH
44 STA SXH
45 ASL
46 ROR SXH
47 ROR SXL
48 LDA X,LIFSZL
49 SEC              ROUND
50 ADC Y,LIFSZL
51 STA SZL
52 LDA X,LIFSZH
53 ADC Y,LIFSZH
54 STA SZH
55 ASL
56 ROR SZH
57 ROR SZL
58
59 FALL INTO YVGVCT
60 .SBTTL UTILITY - QUICK BLANK VECTOR FROM SX,SZ
61 UPDATES CURNTX 2 AND CURNTY 2 WITH SXL 2 AND SZL 2 .
62 UPDATES VGY
63 YVGVCT LDY VGY
64 LDA SZL
```

```
1 STA NY,VGLIST
2 INY
3 STA CURNTY
4 LDA SZH
5 STA CURNTY+1
6 AND I,1F
7 STA NY,VGLIST
8 INY
9 LDA SXL
10 STA NY,VGLIST
11 INY
12 STA CURNTX
13 LDA SXH
14 STA CURNTX+1
15 AND I,1F
16 STA NY,VGLIST
17 INY
18 STY VGY
19 RTS
20 .SBTTL  DISPLAY - ENEMY LINES  TIP STUFF
21
22          PLACES VECTOR TO NEAR PT AND
23          DOT STAT COLOR, JSRL DOT  OR
24          SHATTER SCAL, SHATTER JSRL PIC
25          INTO VGLIST  VGY
26 TIPACT   OR IF INACTIVE, 4 SCAL 1,05
27          LDX INDEX2
28          LDA X,LINCY
29          IFEQ          LINE ACTIVE
30          LDY VGY       NO. FILL WITH SCAL 1,0
31          LDX I,03
32          BEGIN        LOOP TO FILL 8 BYTES
33          LDA I,0       SCAL 1,0 LSB  NOOP
34          STA NY,VGLIST
35          INY
36          LDA I,71      SCAL 1,0 MSB  NOOP
37          STA NY,VGLIST
38          INY
39          DEX
40          MIEND
41          STY VGY
42          ELSE
43          STA PYL       LINE IS ACTIVE
44                      CALCULATE NEAR PT.
45          JSR CHKDEP    YES, CHECK EYE
46          LDA X,LINEXM  X COORD OF MIDWAY PT.
47          STA PXL
48          LDA X,LINEZM  Z COORD OF MIDWAY PT.
49          STA PZL
50          JSR WORSCR    PROJECT ENEMY LIVE NEAR PT.
51                      SAVE NEW COORDINATES
52          JSR FCONNEC   DRAW VECTOR TO NEAR PT.
53          LDX INDEX2
54          LDA X,LINSTA
55          AND I,40
56          IFNE          WHAT S HAPPENING AT TIP
57          JSR CASCAL    SHATTERED
58                      SET PROJECTION SCALE
59          LDA RANDOM
60          AND I,2
```

```
1 CLC
2 ADC I,PTSPAR
3 TAX DETERMINE SHATTER PIC
4 LDA X,PICHI
5 INY INSERT JSRL TO SHATTER PIC
6 STA NY,VGLIST
7 DEY
8 LDA X,PICLO
9 STA NY,VGLIST
10 INY
11 INY
12 STY VGY
13 ELSE
14 WHITIP LDY VGY JUST A DOT AT TIP
15 LDA I,WHITE COLOR SET STAT WHITE
16 STA NY,VGLIST
17 INY
18 LDA I,68
19 STA NY,VGLIST
20 INY
21 LDA JSRDOT INSERT JSRL TO DOT
22 STA NY,VGLIST
23 INY
24 LDA JSRDOT+1
25 STA NY,VGLIST
26 INY
27 STY VGY
28 ENDIF
29 ENDIF
30 RTS
31 .SBTTL DISPLAY UTILITY - FAST CONNECT
32 DRAW VECTOR OF INTENSITY 0A0
33 FROM CURNTX, Y, TO SX, SZ
34 FCONNEC LDY VGY
35 LDA SZL
36 SEC
37 SBC CURNTY
38 STA NY,VGLIST
39 INY
40 LDA SZH
41 SBC CURNTY+1
42 AND I,1F
43 STA NY,VGLIST
44 INY
45 LDA SXL
46 SEC
47 SBC CURNTX
48 STA NY,VGLIST
49 INY
50 LDA SXH
51 SBC CURNTX+1
52 AND I,1F
53 ORA I,0A0
54 STA NY,VGLIST
55 INY
56 STY VGY
57 RTS
58 .PAGE
59 .SBTTL UTILITY - VG ABS POS
60 VGYAB1
```

```
1 LDY I,0
2 TYA
3 STA NY,VGLIST
4 LDA I,71
5 INY
6 STA NY,VGLIST          SCALE BINARY 1, LINEAR 0
7 INY
8 BNE NOLABS
9 VGYABS LDY I,0
10 NOLABS LDA I,40          INPUT X BASE PAGE LOC OF SCREEN COORDINATE PAIR
11 STA NY,VGLIST          VG CENTER
12 LDA I,80
13 INY
14 STA NY,VGLIST
15 INY
16 LDA ZX,2
17 STA CURNTY
18 STA NY,VGLIST          VCTR DELTA Z
19 INY
20 LDA ZX,3
21 STA CURNTY+1
22 AND I,1F
23 STA NY,VGLIST
24 LDA ZX,0
25 STA CURNTX
26 INY
27 STA NY,VGLIST          DELTA X
28 LDA ZX,1
29 STA CURNTX+1
30 AND I,1F
31 INY
32 STA NY,VGLIST
33 JMP VGADD          OUTPUT BEAM AT ABS. POS.
34                      CURNTX,Y BEAM COORDS.
35                      VGLIST UPDATED
36 .PAGE
37 HLL65
38
39
40
41
42
43 .END
44
45
46
47
48
49
50
51
52
53
54
55
56
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58
59
60
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