

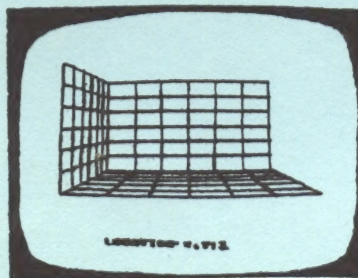
Sebree's Computing

PRESENTS

3-rd. DIMENSIONAL

COMPUTER GRAPHICS

ATARI 800



BASIC LANGUAGE

Version 12.5 B.ED

SEBREE'S COMPUTING

PRESENTS 3-DIMENSIONAL COMPUTER GRAPHICS

****ATARI 400/800****

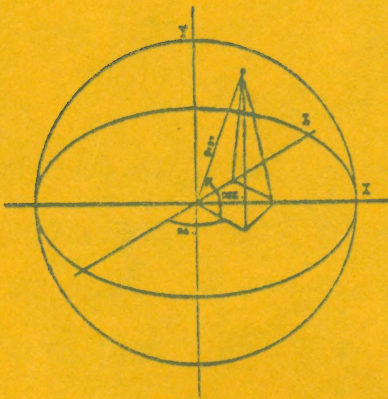
5th Printing

©1980 Sebree's Computing-ATARI 800

BASIC VERSION

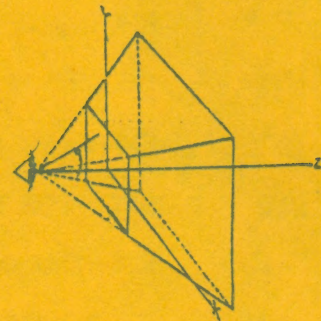
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Registration number:

A-1227



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March 1980

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IMPORTANT NOTICE!!!

If, for some reason, your cassette program doesn't load, try advancing the tape a little (1 to 5 on the tape counter). This should remedy the problem in most cases. If you still have loading problems, it is because your ATARI 410 program recorder does not have the tape heads aligned properly. To align the tape heads, use the following procedure:

- 1) Insert the ATARI EDUCATION SYSTEM master cartridge.
- 2) Insert any ATARI EDUCATION SYSTEM cassette (Psychology, Physics, etc.) into your ATARI 410 program recorder.
- 3) Find a small screwdriver, (a jeweler's screwdriver, etc.) which will fit in the tiny hole just above the playback head, (above the letter 'T' in the ATARI 410 logo). Some units may differ and/or the head-adjust screw may not be easily accessible. The screw is bracing the playback head, press down 'PLAY' and you may see it.
- 4) Press 'PLAY' on the recorder and press 'START' on the ATARI.
- 5) When the EDUCATION LESSON starts, watch for glitches on the TV screen. If there are glitches, adjust the screw with the screwdriver until the glitches are just about gone. Then, rotate the screw a little bit farther until you hear the DATA track (what you hear when you load in a program).
- 6) Now, listen very carefully and adjust the screw until the DATA track is just barely audible, this is the point which the two tracks (A & B) are separated so the audio track (the voice you hear) does not interfere with the DATA track.

Now, try loading that hard-to-load cassette. If it still doesn't load after doing this, try CLEANING AND DE-MAGNETIZING the tape heads. If the cassette still doesn't load after following ALL of the above listed procedures, then the tape itself is bad (dropout or glitch in tape, etc.), and you can return it for a new copy.

NOTE: SEBREE'S COMPUTING uses the TOK 'D' series 'Music Machine' high quality cassettes, SCOTCH brand cassettes, and BASF Computer tape exclusively.

NOTE note: It is advised that the user make himself a backup copy of the software so the user may not have any future problems, but please conform with all of the COPYRIGHT rules, that this is the only time the user may copy software- for his/her OWN USE. Copying software and selling it or giving it to a friend is illegal, against all COPYRIGHT rules, and may end in prosecution.

3-DIMENSIONAL COMPUTER GRAPHICS

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COVER 2

INTRODUCTION

Since its inception more than a decade ago, the field of computer graphics has captured the imagination, and technical interest of rapidly increasing numbers of individuals from all society. A high percentage of the growing ranks of computer graphics professionals has given primary attention to: computer-oriented problems in programming, system design, hardware, (not to mention Software), etc. etc.

A NEW and rapidly expanding field called 'Computer Graphics' is emerging.

Very FEW individuals know enough about the hardware, software, micro-processors, theory of design, the mathematics of computer graphics, color control, and the individual machine they are working with; in order to write, test, & debug 3-d graphics software effectively. This is why we, at SEBREE'S COMPUTING have decided to put MANY months work into this advanced graphics package. This package has a very powerful set of programs in which the applications start with major areas, such as: Management information, Scientific graphics, Command and control, Image processing, Real-time image generation & simulation, Electrical & mechanical design, and the applications just go on, and on.

The problem is: Each application area calls for markedly different hardware and software. So unique are those requirements that few existing systems can meet most of the demands posed by; even just a single class of applications. This program package HAS taken all of this into consideration; The software was written to be as versatile as possible, while still limiting itself in memory usage.

Most 3-D graphics users are interested primarily in using the software in their own special application. The design of the software made it fairly simple for the user to alter it, or use it as-is for his application. There are very few things that the user is required to know to use this package. You will have to recall some simple 3-D Coordinate Geometry that you learned in High School.

The ATARI uses the top-left corner of the screen as 0,0, but this software uses the very center of the screen for: 0,0,0 (X,Y,Z). The location YOU will be viewing the scene from will usually be 0,0,0. A data base (scene) in memory will usually be located at a depth (Z) of 100 or more, so the scene is in front of you. If the depth is equal to the viewers location (0), then you will end up standing inside of the object you wish to view! If this is the case, simply enter a negative depth for the viewers location, thus:

VIEWERS LOCATION X,Y,Z.
0,0,-100

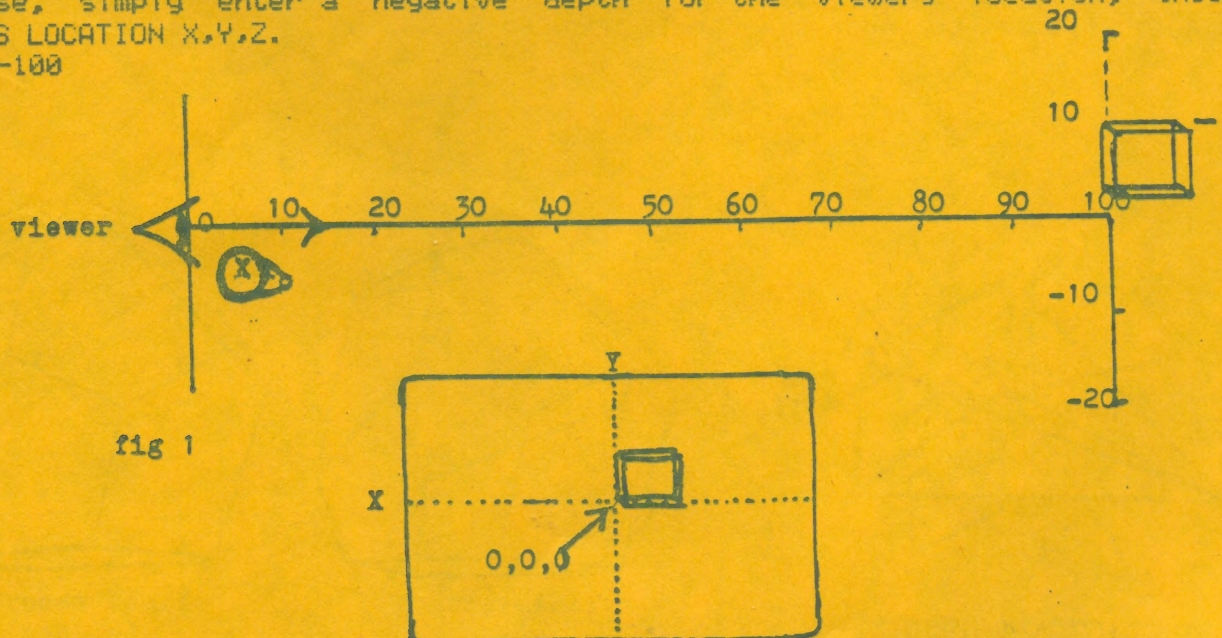


fig 1

LINE CLIPPING AND PUSHING

_ One of the most important items in a Graphics package; the ability to draw objects that lie partially on the screen. This software will do just that with perfect precision, up to the last pixel on the very edge of the screen. When a line is partially on the screen, the program GOSUBS into a series of 'Clipping & Pushing' functions, until both edges of the line intersect the edges of the screen. This is the computation which takes the longest to perform, deciding which way to push the line, and how far.

_ Polygon clipping reduces a polygonal surface extending beyond the boundary of the screen. The process 'clips off' those parts of the polygon which lie outside the window. The perspective computations alone are inadequate to meet most needs because they will erroneously project points behind the observer upside down and backwards onto the screen in front of him. The final division process in the perspective projection destroys one bit of signal information, and this is precisely the bit that keeps objects in front of an observer in front of him. If a line connects a point in front of an observer with a point behind him, it will project a very strange looking line if it's ends are simply projected by the ordinary rules.

Moreover, a point 'alongside' the observer, with the same value 'Z' as his eye, projects into a point with infinite values of 'X, Y, & Z', clearly a difficult point to represent. The point being, we must limit the values of 'X, Y, Z, & W' PRIOR to doing the division. If we are careful to limit the values of 'X, Y, Z, & W' appropriately, we can make the range of possible values for X, Y, & Z come out to be very simple. For example, it would be nice to have x & y in the range -1 to +1, because they would then be easy to scale to any available precision in a subsequent depth computation.

This suggests that we always clip on the limits: $-w \leq x \leq +w$, $-w \leq y \leq +w$, $0 \leq z \leq +w$. These clipping limits correspond to six planes which we will call 'left', 'right', 'bottom', 'top', 'hither', and 'yon'. The six clipping planes form a truncated pyramid. In raw form, the transformation and clipping result in a fixed field of view. _ This package draws 'wire frame' objects only, as shown below. There is no hidden-line capability, simply because it takes too much time and memory to do so.

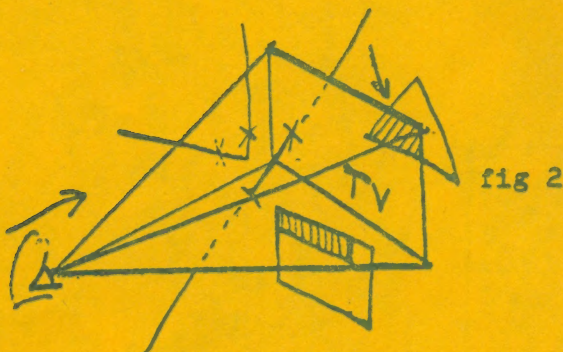
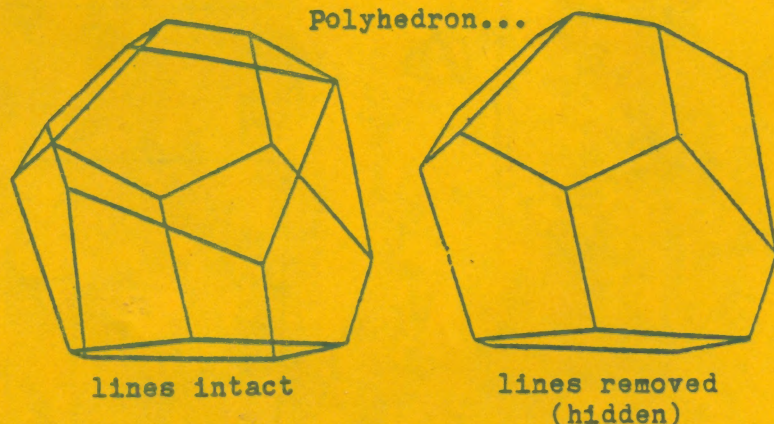


fig 2

LINE CLIPPING & PUSHING



Polyhedron...

lines intact

lines removed
(hidden)

PERSPECTIVE PROJECTIONS

- We are concerned with the computer processing of three-dimensional data, to produce realistic two-dimensional pictures. When producing perspective pictures of opaque objects, we use depth information to perceive: which of the two objects is nearer the observer. We might do these computations before making the perspective projection, using the true depth of objects for comparison but we would then be troubled by the difficulty of computing: the relative lateral position of objects considering the parallax of the viewpoint. It is generally much more convenient to make a three-dimensional perspective projection first, since this projection puts all of the objects into their correct positions on the screen, while preserving not only depth ordering but also the fact that straight lines project into straight lines.

In effect, the application of a proper perspective projection to a set of three-dimensional objects, enables us to treat the objects as if they were being viewed from infinity. The problem of available depth resolution has been a plaguing factor for some time. With hither and yon clipping, the available range of perspective depth is distributed as uniformly as possible, over the space between the hither and yon clipping planes. As you might expect, the closer the hither and yon clipping planes are to each other, the more depth resolution will be available in the space between them.

LOAD & GO.....

- You're probably pretty anxious to start by now, so put in the tape or disk and load-in the first program. When the screen prompts you with 'READY', type RUN and press RETURN twice. This program is an intro with the titles of all the cassette programs in succession, there are six. This program uses user-defined text modes which will be explained later. This program will automatically load in the next program, the next should be loading in if you pressed RETURN twice.

PROGRAM>-- OVERSCAN.

- Now type in RUN again and read the screen. This program is a neat little polygon plotter which we shall use to determine our needed 'overscan'. The OVERSCAN variable (OVS) is used to correct the problem we have with the pixels on the screen: NOT being perfectly square. If we put a square onto the screen measuring 40 x 40 pixels, it would really appear to be a rectangle. The overscan variable is used in conjunction with the software to alleviate this problem.

This is how you will use the program:

NUMBER OF SIDES?

?30

RADIUS OF PLOT? (HI-RES MAX=154)

?40

DIAMETER PLOT ONLY? 'Y'=YES

?Y

GRAPHICS RESOLUTION? (MODE 3-8)

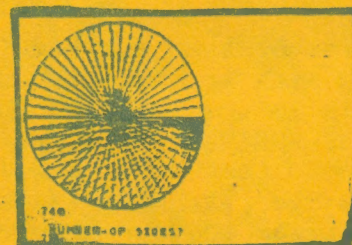
?7

CLEAR THE SCREEN? 'Y'=YES

?Y

COLOR? ALWAYS '1' FOR HIRES

?1



SAMPLE OUTPUT OF OVERSCAN PROGRAM

The program will now plot out a circle in graphics mode 7, with a color of '1' (gold). If you have 8K memory, you will have to use graphics modes '5' or '7' from now on (when the screen asks: SCREEN RESOLUTION?). If you have 16K memory or more, RUN the above and replace GRAPHICS RESOLUTION with an '8'. REMEMBER: Disk drive systems will have to add an extra 8K of memory to all of these noted requirements!

_ If the circle is definitely not the same width as it is height, follow the steps in REM lines 100-on, to re-adjust the overscan (OVS) so that the circle is always symmetrical. Now, write this variable value down in this manual so you will know what number to replace OVS with later. I suggest RUNNING this program and playing with it for a while, using different values for the input prompts, you will get some amazing results. This program is quite versatile and has many options programmed in it. Even if you have more than enough memory, try the other graphic modes, & mix the circles in different colors.

_ You may notice the screen go blank after you input COLOR, that is because all the screen, sound, and I/O interrupts have been masked out temporarily. This running portion of the program make take a few seconds, masking out the interrupts will cause a : 34% faster execution time!! The method of doing this will be revealed later. NOTE: This overscan program is not a 3-D program, it is used to correct the individual TV monitor screen sizes, for the output in the 3-D programs to follow.

Now, load in the next program, PYRAMID.3D

_ All of these programs were written in ATARI BASIC but they execute suprisingly fast, program design spent many LONG hours working on speeding up this process. When READY appears, type RUN and hit RETURN. The screen immediately asks 'SCREEN RESOLUTION?', this is self explanatory and uses graphics modes 5, 7, & 8..If you enter a '1', you chose GRAPHICS 5 (80 x 40). If you entered in a '2', you chose GRAPHICS 7 (160 x 80). If you chose a '3', you get GRAPHICS 8 (320 x 160, HI-RES). The first two modes can be used with multi-colors. Refer to the ATARI reference manual when using the SETCOLOR statement. Later, you will see how to get more colors in GRAPHICS mode 8!!

GRAPHICS mode 8 is very high in resolution, and takes up 8K of memory alone. 8K users will have to live with low resolution and programs 1 to 4 until they get more memory. Enter in a '2' for SCREEN RESOLUTION, you are now prompted with FIELD OF VIEW. Think of having a camera with a zoom lens on it. Small values (.1) will make the object larger as if you are 'zooming' in on the scene. Larger values (approaching 2.0) will zoom away from the scene making it smaller. So, enter a '.5' for FIELD OF VIEW, the software defaults to a '.5' (.5 is about an average field of viewing).

_ The screen clears and prompts you with a VIEWERS LOCATION X,Y,Z, enter ' ?0,0,0 '. This is the location you are standing in the three coordinate system. Next is HEADING, PITCH, & BANK, enter ' ?0,0,0 '. HEADING is the direction your head (or your eyes) is facing. PITCH is the direction up or down your head is aimed at. BANK is the direction you have rotated your head, (touch your right ear to your shoulder and you will be looking at the world at approximately a 60 degree angle). HEADING rotates on the 'Y' axis, PITCH rotates on the 'X' axis, and BANK rotates on the 'Z' axis.

_ The following page shows actual photos of the screen so you can refer to them, when you aren't sure where you want your scene to move to. The numbers below them correspond to the two sets of inputs, VIEWERS LOCATION, & HEADING PITCH, & BANK. Now, enter a '1' for COLOR. The color should always be a '1' in the HI-RES mode. That is, unless you wish to erase a scene you just put up.

Of course, you may wish to erase a certain object you put on the screen and replace it somewhere else, that can be done by re-drawing the object you want erased using COLOR=2 or 4, then redrawing it in a solid color (1) somewhere else. You can now have many views of an object on the scene at once in different colors. You will learn how to rotate the colors on the screen later, which gives a fascinating, moving animation effect!!

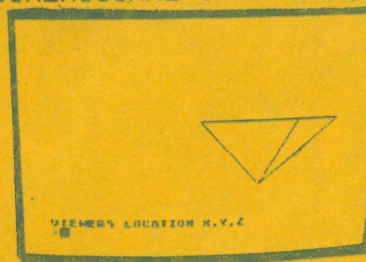
Now, enter a 'Y' for CLEAR SCREEN? YES?, and you shall see a head-on view of a 5 sided pyramid (upside down), and hear a 'click' when each line is drawn on the screen. This 'click' is a simple POKE 53279,0 to 'click' the internal speaker, and is used in all the other 3 three-dimensional graphics programs. Quite a handy debugging aid and nice addition.

The screen will now say VIEWERS LOCATION X,Y,Z again, this is where you experiment. Use the following examples as guidelines.

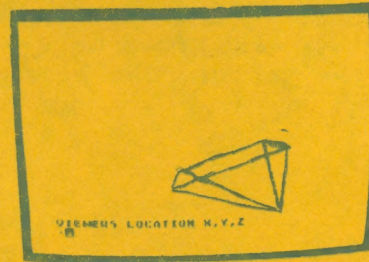
NOTE: In the view of the object you have on the screen right now, you can see only 4 of the 8 lines visible, because you are looking at it head-on, (moving it, or your viewing location will allow you to see the entire object.

Note the differences in the photos below.

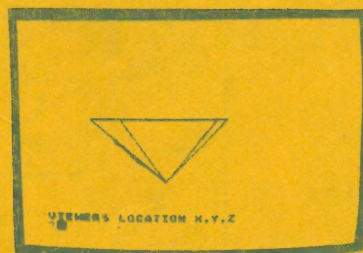
The OVERSCAN correction was not used in this program so that it would run in 8K using SCREEN RESOLUTION = '1'. It will be used in all the rest of the 3-DIMENSIONAL GRAPHICS programs in this package.



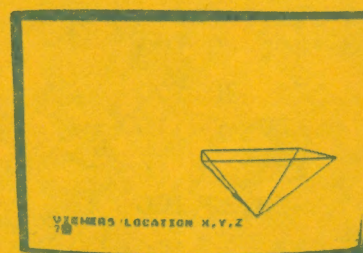
VIEWERS LOCATION 0,0,0
HEADING, PITCH, BANK 0,0,0



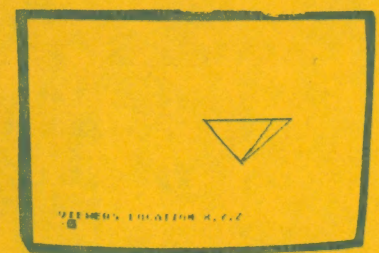
250,250,0
0,0,30



VIEWERS LOCATION 300,0,0
HEADING, PITCH, BANK 0,0,0



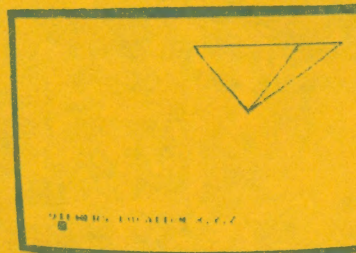
0,200,0
0,0,0



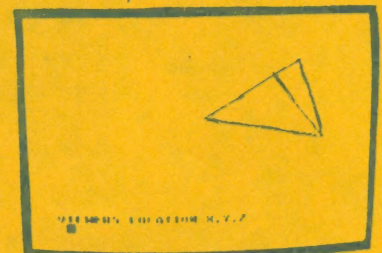
0,0,-500
0,0,0



VIEWERS LOCATION 0,0,0
HEADING, PITCH, BANK -20,0,0



0,0,0
0,20,0



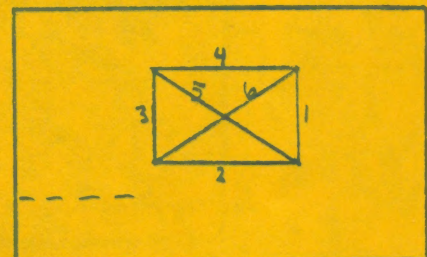
0,0,0
0,0,45

COLOR 1 , puts up a solid gold, providing you havn't changed any of the color registers. COLOR 2 ,puts up a light green. COLOR 3 , is dark blue. COLOR 4 is black and therefore erases anything in its path. You have quite a compliment of color control using the SETCOLOR statement, but with only 3 colors, you can create quite a variety of display variations, by putting 2 or 3 colors close to each other. You can draw an object, and redraw it slightly off-center from the first one using a different color- creating a depth effect on the object. Remember, when using GRAPHICS 8 mode, you can only use 1 color, at least until you see what you can do to get around that.

PROGRAM # , USER.3D inputting data

After you feel you can manipulate the first 3-D program fairly enough load in the next program, called USER.3D. This program allows the user to input his/her own scenes through the use of simple input statements. Try to recall your Coordinate (graph paper) geometry. After inputting the screen resolution and field of view, enter the number of lines you want displayed on the screen. The computer will now ask for the starting point of line #1. Either enter in your own data, or follow this example:

```
# OF LINES-- 6
LINE #1 START POINT
?20,20,100
END POINT
?20,-20,100
#2 Start Pt. 20,-20,100
End Pt. -20,-20,100
#3 Start Pt. -20,-20,100
End Pt. -20,20,100
#4 Start Pt. -20,20,100
End Pt. 20,20,100
#5 Start Pt. -20,20,100
End Pt. 20,-20,100
#6 Start Pt. 20,20,100
End Pt. -20,-20,100
```



```
VIEWERS LOCATION
?0,0,0
PITCH BANK & HEADING
?0,0,0
COLOR
?1
```


LETTERS '3-D'

1 START PT. -30,15,100
END PT. -15,15,100
2 START PT. -15,15,100
END PT. -15,10,100
3 START PT. -15,-10,100
END PT. -30,-10,100
4 START PT. -30,-10,100
END PT. -30,-5,100
5 START PT. -30,-5,100
END PT. -20,-5,100
6 START PT. -20,-5,100
END PT. -20,0,100
7 START PT. -20,0,100
END PT. -25,0,100
8 START PT. -25,0,100
END PT. -25,5,100
9 START PT. -25,5,100
END PT. -20,5,100
10 START PT. -20,5,100
END PT. -20,10,100
11 START PT. -20,10,100
END PT. -30,10,100
12 START PT. -30,10,100
END PT. -30,15,100
13 START PT. 5,0,100
END PT. -10,0,100
14 START PT. -10,0,100
END PT. 5,5,100
15 START PT. 5,5,100
END PT. 5,0,100
16 START PT. 10,15,100
END PT. 10,-10,100
17 START PT. 10,-10,100
END PT. 20,-8,100
18 START PT. 20,-8,100
END PT. 25,-4,100
19 START PT. 25,-4,100
END PT. 25,4,100
20 START PT. 25,4,100
END PT. 20,8,100
20 START PT. 20,8,100
END PT. 10,15,100
22 START PT. 15,-4,100
END PT. 20,2,100
23 START PT. 20,3,100
END PT. 15,4,100
24 START PT. 15,4,100
END PT. 15,-4,100
25 START PT. 10,15,100
END PT. 10,-10,100

VARIABLES IN ALPHABETICAL ORDER

A - LOOPING
A1 - NESTED LOOPING WITH 'O & A'
B - BANK OF ROTATION
C(4) - INPUT 'YES' OR 'NO' STRING
COL - COLOR
D(8) - MATRIX VAR
DM - VALUES FOR INTERRUPTS
H2 - WIDTH OF SCREEN
I - READ-IN 'Y' VAR
IR - INTERRUPT REGISTER VALUE
J - MATRIX VAR
L3 - TEMPORARY STORAGE- MATRIX GENERATOR
L4 - TEMPORARY STORAGE- MATRIX GENERATOR
L5 - TEMPORARY STORAGE- MATRIX GENERATOR
L6 - TEMPORARY STORAGE- MATRIX GENERATOR
L7 - TEMPORARY STORAGE- MATRIX GENERATOR
L8 - TEMPORARY STORAGE- MATRIX GENERATOR
L9 - TEMPORARY STORAGE- MATRIX GENERATOR
LA - LINES OFF SCREEN WINDOW
LH - SET TO '0' IF OFF SCREEN
LP - LOOPING
LS - LENGTH OF STRINGS TO BE COLLECTED
M9 - HIRES MULTI-COLORS CORRECTION
OVS - OVERSCAN CORRECTION
P - PITCH OF VIEWER
P1 - GOTO P1 VAR
P2 - GOTO P2 VAR
PA - LOOPING
PX - INPUT FOR VISIBLE, NON-VISIBLE PROCESSING
PY - LOOPING
Q(228) - 'X' DATA FOR SPACE SHUTTLE
R(228) - 'Y' DATA FOR SPACE SHUTTLE
R1 - STORAGE- TRANSFORMATION MATRIX
R(228) - 'Y' DATA FOR SPACE SHUTTLE
R2 - STORAGE- TRANSFORMATION MATRIX
R3 - STORAGE- TRANSFORMATION MATRIX
R4 - STORAGE- TRANSFORMATION MATRIX
R5 - STORAGE- TRANSFORMATION MATRIX
R6 - STORAGE- TRANSFORMATION MATRIX
RN - CURRENT LINE# BEING DRAWN
S - MATRIX VAR WITH '0'
S(228) - 'Z' DATA FOR SPACE SHUTTLE
SH - TRIG. CORRECTION
SR - INPUT VARIABLE
T - TRUE-FALSE STATUS (1 OR 0)
TR - LOOPING VARIABLE
U - READ-IN VAR FOR 'X'
V - INPUT FOR FIELD OF VIEW
X(5) - 'X' POINTS TO BE PLOTTED
Y(5) - 'Y' POINTS TO BE PLOTTED
Z(5) - 'Z' POINTS TO BE PLOTTED

VIEWERS LOCATION -110,-30,0
HEADING,PITCH,BANK -40,-10,-45



When all the lines (data) have been put in, the program will ask for overscan correction, enter 'Y' or 'YES'. The preceding set of inputs will place a square with an 'X' through it on the screen. Just input your VIEWERS LOCATION, & HEADING, PITCH, & BANK as before. Try doing some rotations of this object without clearing the screen, you shall get some interesting results.

Here are some examples to use:

of lines-- 12

CUBE

1	Start point	20,20,100
	End point	20,-20,100
2	Start point	20,-20,100
	End point	-20,-20,100
3	Start point	-20,-20,100
	End point	-20,20,100
4	Start point	-20,20,100
	End point	20,20,100
5	Start point	20,20,140
	End point	20,-20,140
6	Start point	20,-20,140
	End point	-20,-20,140
7	Start point	-20,-20,140
	End point	-20,20,140
8	Start point	-20,20,140
	End point	20,20,140
9	Start point	20,20,100
	End point	20,20,140
10	Start point	-20,20,100
	End point	-20,20,140
11	Start point	-20,-20,100
	End point	-20,-20,140
12	Start point	20,-20,100
	End point	20,-20,140

PYRAMID WITH BASE

1	START PT.	-20,0,140
	END PT.	-20,0,100
2	START PT.	20,0,140
	END PT.	20,0,100
3	START PT.	-20,0,100
	END PT.	20,0,100
4	START PT.	-20,0,140
	END PT.	20,0,140
5	START PT.	-20,0,140
	END PT.	20,0,100
6	START PT.	20,0,140
	END PT.	-20,0,100
7	START PT.	-10,0,130
	END PT.	10,0,130
8	START PT.	-10,0,110
	END PT.	10,0,110
9	START PT.	-10,0,130
	END PT.	10,0,110

10	START PT.	10,0,130
	END PT.	10,0,110
11	START PT.	10,0,130
	END PT.	0,50,120
12	START PT.	-10,0,130
	END PT.	0,50,120
13	START PT.	10,0,110
	END PT.	0,50,120
14	START PT.	-10,0,110
	END PT.	0,50,120

VIEWERS LOCATION 60,0,0
HEADING,PITCH,BANK 20,0,0

VIEWERS LOCATION 40,40,0
HEADING,PITCH,BANK 10,10,-20

CONES

1	START PT.	0,15,100
	END PT.	0,-15,300
2	START PT.	10,5,100
	END PT.	-10,-5,300
3	START PT.	0,-15,100
	END PT.	0,15,300
4	START PT.	10,5,300
	END PT.	-10,-5,100
5	START PT.	-10,5,100
	END PT.	10,-5,300
6	START PT.	-10,5,300
	END PT.	10,-5,100
7	START PT.	0,15,100
	END PT.	-10,5,100
8	START PT.	-10,5,100
	END PT.	-10,-5,100
9	START PT.	-10,-5,100
	END PT.	0,-15,100
10	START PT.	0,-15,100
	END PT.	10,-5,100
11	START PT.	10,-5,100
	END PT.	10,5,100
12	START PT.	10,5,100
	END PT.	0,15,100
13	START PT.	0,15,300
	END PT.	-10,5,300
14	START PT.	-10,5,300
	END PT.	-10,-5,300
15	START PT.	-10,-5,300
	END PT.	0,-15,300
16	START PT.	0,-15,300
	END PT.	10,-5,300
17	START PT.	10,-5,300
	END PT.	10,5,300
18	START PT.	10,5,300
	END PT.	0,15,300

STORING DATA BASES

- With the exception of the transformation generator, clipping & pushing, display driver, and a few other matrix routines, the program is very straightforward. You will need to know how to store your own scene on memory, so load in the next program, called CORNERS.3D. 8K users will have to refer to program #3, the pyramid program to do what comes next. RUN the CORNERS.3D program and enter the various values for X, Y, & Z so you can get familiar with the scene. The scene shows what looks like a wall, a floor, and a wall separating the two. What you might expect to see if you could see through a corner of a room. The pattern was laid out like a grid, the surface texture gives it depth and greatly enhances the object. Keep this method of surface-treatment in mind when you are designing your own scene.

- LIST the program and inspect it, or study the listing. Note that the data for the scene starts at line # 130, and continues to line # 220. This is the method in which you will store your data base. At line # 10, you will see that LS=39. This means that there are 39 lines that will be displayed (LS= number of lines). At line # 110, you will see the DIM statements, using Q, R, S, as storage. Always DIM Q(A), R(A), S(A), 'A' is the total number of start and end points, or, the number of lines multiplied by 2 plus 1. Thus, 'A' equals 79 in this particular program.

- You may want to refer to the listing when doing this: In that same line number, (# 110) find the statement that reads: FOR TR=1 TO 78. This FOR-NEXT loop reads the data into the Q,R,S arrays. '78' is the total number of points to read in (LINES times 2). Change this number to the new number of points in your data base. Do the same for PY and PR in line # 120. Then go ahead and enter in your own data base. You can use any lines from 130 to 1999 for your data base without any modification to the program whatsoever. You may want to try to load into DATA statements one of the examples now, or keep reading for more information, (on everything discussed so far).

- The listing of program #6, AUTO.3D, the last program on the cassette, is the best one to use for study purposes. This program is intended as a DEMO program for dealers, distributors, or just for anyone who likes to watch a good, versatile graphics program. This listing will show the user how to expand the base program and include 2 or more scenes, which CAN be shown on the screen at the same time. Load in the final program and RUN it. You will notice many more options included in this program. The first thing you should do is: enter in your OVERSCAN correction. The OVERSCAN should be entered into the program at the beginning of the listing, line # 15 in this case. NOTE: It is advised that the user make himself a copy of each program with his OVERSCAN correction on it. Copying of this software is only allowed to the person who purchased it.

- Look at the 10000 block to see how you can GOSUB a certain scene and change the parameters, (values for the scene viewing) automatically. The 3000 to 7000 block is where the Space Shuttle data is stored, and has REM statements, showing where the beginning of the data for X, Y, & Z are located. When you store your data like this, start by typing a line number, DATA, followed with the data for 'X'. For example, you want to store 3 lines, so make LS=3. Now, take the number of lines of the value of LS, multiply it by 2 and add 1. $3 \times 2 + 1 = 7$. Now, DIM Q(7), R(7), and S(7).

- NOTE: Main portions of this manual have been printed by using the BASIC EDITOR (C) program by SEBREE'S COMPUTING. This program sells for \$15.95 +\$.75 p&h. Notice how nicely formatted these sections are.

There are 6 points to read in for the X,Y,& Z values, so your FOR-NEXT loops will all be from 1 to '6'. There is really nothing else which needs to be said if you just look at the listing below for a minute and see for yourself that everything just discussed has been taken care of.

Line #1	Start Pt.	-30,20,200
	End Pt.	26,15,230
Line #2	Start Pt.	-38,40,100
	End Pt.	27.5,-14,150
Line #3	Start Pt.	0,-29.8,300
	End Pt.	37,-43,360

(Yes, full floating point values are permitted)

The DATA lines would be as follows:

```

10 GR.0:LS=3
110 DIM Q(7),R(7),S(7),X(5),Y(5),Z(5),D(8):
    FOR TR=1 TO 6:READ U:Q(TR)=U:NEXT TR
120 FOR PY=1 TO 6:READ I:R(PY)=I:NEXT PY:
    FOR PR=1 TO 6:READ E:S(PR)=E:NEXT PR
130 REM Data for X
140 DATA -30,26,-38,27.5,0,37
150 REM Data for Y
160 DATA 20,15,40,-14,-29.8,-43
170 REM Data for Z
180 DATA 200,230,100,150,300,360
  
```

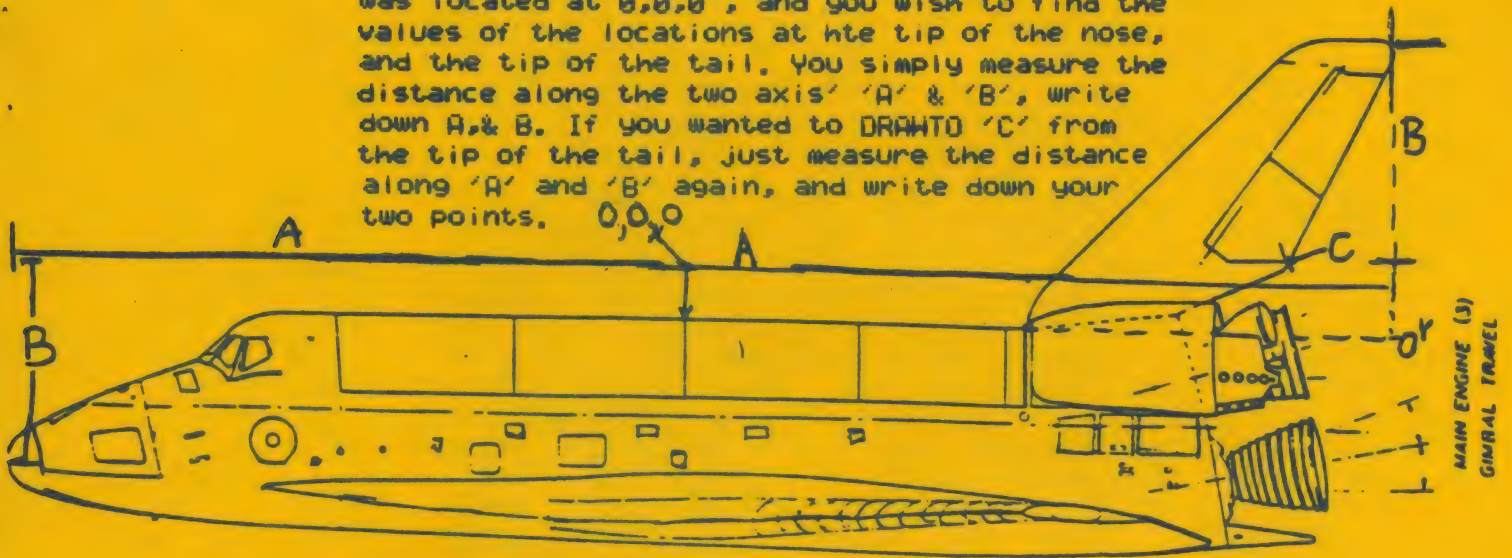
COMPATIBILITY

If you are using this software on another system, or are planning to, there is very little that has to be changed except for the colors. Lines # 70, 80, 90 have to do with the screen resolution. HZ is the number of pixels on the screen from left to right, divided by 2 minus 1. Always specify hz on another system. GP is the graphics mode to be used, simply eliminate this. Get rid of the color command at line 2020. Insert your own commands for color control (if you have any) and anything else you need to control your graphics.

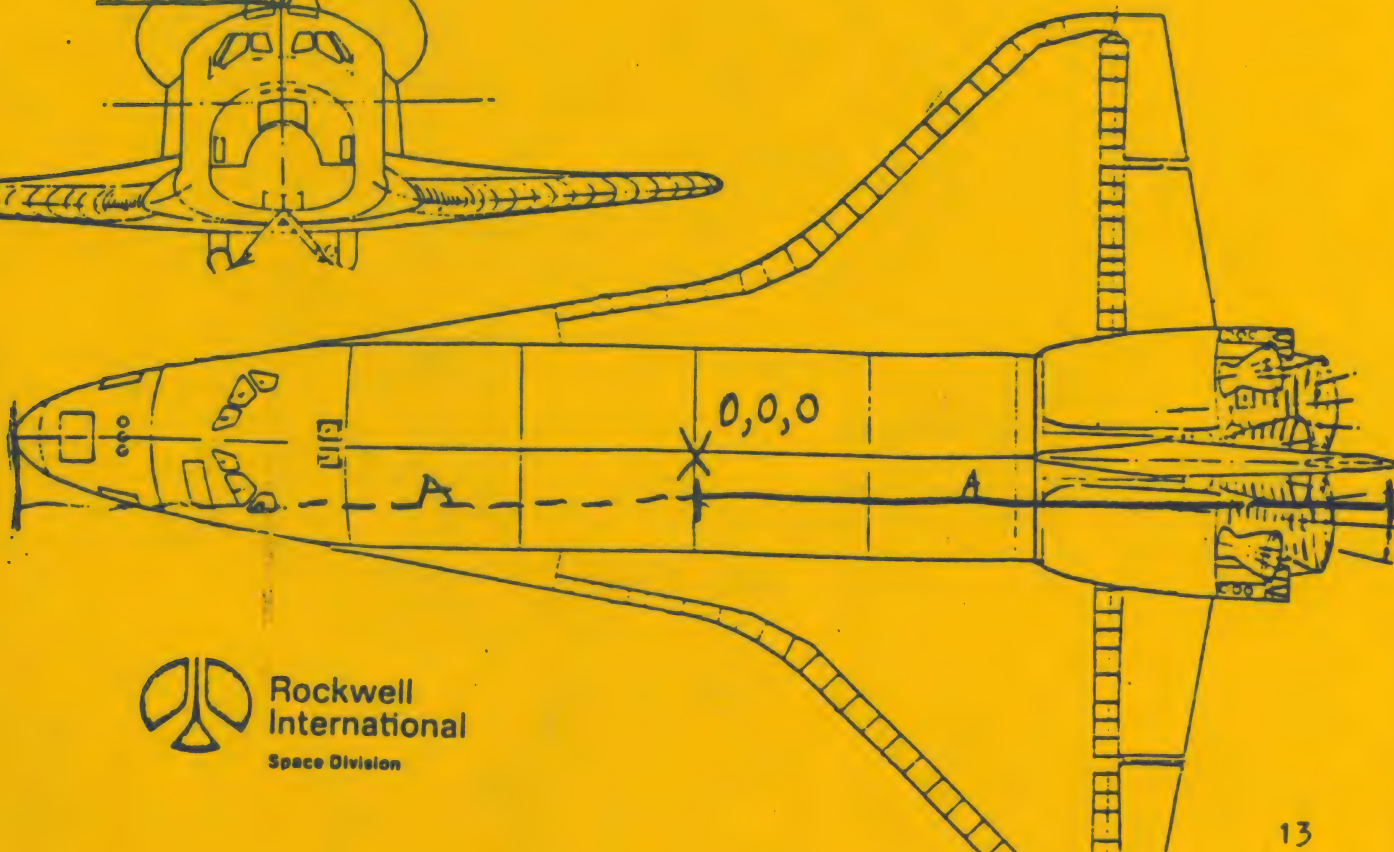
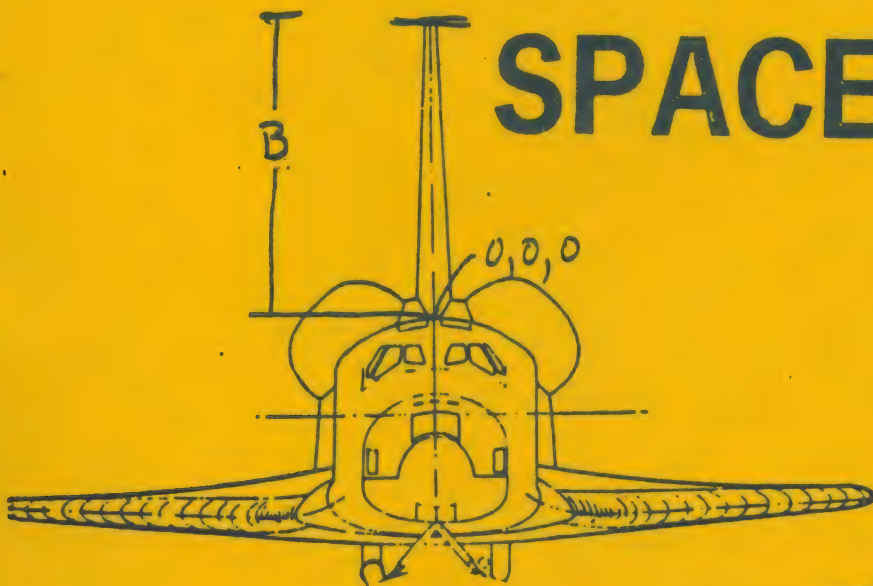
AUTO.3D DEMO program

When running program #6, you may notice a mode of AUTOMATIC LOOPING and USER INPUT. This mode determines whether or not the user will enter in his own LOCATION and the rest of the viewing information. The USER INPUT mode is the earlier default mode. The AUTO LOOPING mode is so you can have the computer choose the viewing information and demonstrate the It takes a few minutes to run through the DEMO mode, which is quite eye-catching. The program, being for display purposes, will continuously loop from control at the 10000 block. If you want to get rid of the wait loops, put a RETURN at 9998 and 9999, or leave out the gosubs at lines 8050, 8000, 8010, 8020, & 8040, and eliminate 9998 and 9999. This will show the speed of the program, it uses all the built-in trigonometric functions for speed and high accuracy. The program runs much faster than BASIC 3-0 Graphics programs on other systems.

THE SPACE SHUTTLE was put into the computer by using a plastic model and drawing it out on paper, here is a copy of the blueprints for the SPACE SHUTTLE. The simple method of finding the points you are going to plot is illustrated. Say, for instance, the very center-top of the body was located at 0,0,0, and you wish to find the values of the locations at the tip of the nose, and the tip of the tail. You simply measure the distance along the two axis 'A' & 'B', write down A, & B. If you wanted to DRAW TO 'C' from the tip of the tail, just measure the distance along 'A' and 'B' again, and write down your two points. 0,0,0



SPACE SHUTTLE



Rockwell
International
Space Division

HINTS & SPECIAL TECHNIQUES

- If you have some trouble with the handling of your own data, first make sure you have: the same number of data numbers (e.g. DATA 10,27,32,4..) as there are 'Points you want to plot times 3'. If you would like to find out all the variables being used in any program, just type SAVE'S: , and press CONTROL and '1' to pause the listing. This will show you the entire contents of RAM in it's 'raw' form. To find the variables currently used, look at the top. The last character in each variable will be in reverse video. So, if you want to see if the variable 'R' has been used, you would expect to see it (the letter 'R') in reverse video. If you are looking for the variable 'OUS', the 'S' would be in reverse video, etc.

- When attempting to plot curves, remember that you will sacrifice speed for quality and vice-versa. When you are doing some graphics where the computer will probably not be touched for a few minutes, I suggest to POKE out the attract mode. This is the mode the ATARI goes into when it hasn't been touched for 4 minutes. The location of the attract mode POKE is 77. You just enter POKE 77,0 somewhere in the running portion of the program. This location uses the internal counter which adds '1' to the value of PEEK(77) every few seconds. If you just poke it with a '0' once, it will just start over counting and eventually go back into attract mode. This is why you shall have to place the poke within the running portion of your program.

- If you like the idea of the buzzer or bell going off when you like it, just type '?CHR\$(253)' to ring the bell, and 'POKE 53279,0' to click the speaker. There is one other tone I like to use from the same oscillator as the bell. When the interrupts have been masked out, so the program runs faster, it also masks out the interrupts that make the bell tone sound like a warble. The result is a smooth, pleasing sound. All you have to do to get this sound is type '?CHR\$(253)' when you are in the blank interrupt mode. The explanation will now follow.

MASKED OUT INTERRUPTS FOR 34% FASTER EXECUTING BASIC

- The QUERSCAN program and the AUTO.30 programs both incorporate the use of masking out the main interrupts. The BASIC instructions to follow, will cut off the sound, screen, and the I/O interrupts. In doing so, you receive a 34% faster execution time!! Knowing this may be worth the price of this package alone!! Just think what you could do with a software-controlled BASIC speed-up! You may place this in any slow BASIC program. This is all you have to do:

- These two lines can be numbered anything you want, and the variables can be changed to whatever you like. Use these two lines as subroutines:

```
100 MI=PEEK (54286):NQ=PEEK (53774):QC=PEEK (54272):POKE 54286,0:POKE 53774,0:  
POKE 54272,0:RETURN  
200 POKE 54272,QC: POKE 53774,NQ: POKE 54286,MI: RETURN
```

- Whenever you would like to speed-up, just GOSUB 100, to restore the screen, just GOSUB 200. Just remember to reset the interrupts, because the 'BREAK' key is locked out. If you have to restore the screen immediately, just hit the SYSTEM RESET key. This will reset all of the interrupts. There is a lot of versatility in this little gem, you will probably end up using it in all of your programs, where you have to wait for an output. The first line (100) stores the current values of the interrupts in the 3 variables, and then blanks those interrupts out. The second line (200) simply recalls those storage variables and replaces them in the interrupt registers.

MEMORY REQUIREMENTS

The amount of memory you need to obtain a certain view of an object depends a lot on: which graphic resolution you are using. If you have only 8K, you can only use '1' when you are asked 'SCREEN RESOLUTION?' by the software. But this is restricted to only the first, 2-3-D programs. If you have 16K, you may use '2' when asked 'SCREEN RESOLUTION?'. But this excludes the final 3-D program. You must have at least 24K RAM to use the final program AUTO.3D. If you wish to get the SPACE SHUTTLE up in 24K RAM, you must follow these steps. First, RUN the program. When you are asked for the DUS correction, type 'YES', or 'NO', it doesn't matter which here. Next, type 'NO' to not run the DEMO mode. For SCREEN RESOLUTION, type a '2'. Type a '1.5' for FIELD OF VIEW. Type a '2' for USER INPUT. Now, type a '1' for visible processing. The program will get the DATA, and clear the screen and ask you VIEWERS LOCATION? This is where you hit the BREAK key and type:

'GOTO 3000' and hit RETURN. You are now getting the data for the SPACE SHUTTLE. When VIEWERS LOCATION? comes up again, hit the 'BREAK' key again and type 'GR.7' and hit RETURN. Now type 'GOTO 2010' and hit RETURN again, and you are all set to enter a new VIEWERS LOCATION with the 'SPACE SHUTTLE' in memory. Try entering all '0's first and then changing the COLOR and moving the view elsewhere. Then change the COLOR again and draw a third object in another spot on the screen. This will give a feeling of depth. NOTE: if you are using a DISK DRIVE with this software, you have to realize that you have to allow extra memory, for the DOS. If you have 32K RAM, you may do these things in HI-RESolution and get some fantastic displays. Try the following: Put up 3 (or more) different views of the object(s) you are viewing in three different colors, (COLOR 1, 2, or 3). Make sure that you do all this in GRAPHICS 7, which is 'MODE 2', when you are asked for the 'SCREEN RESOLUTION?'. Now, hit the 'BREAK' key and type 'GR.40' and hit the RETURN key.

You are now in HI-RES mode but you can see your scene that you built up earlier down at the bottom of the screen, in 3 COLORS!!! Now, type 'POKE 710,0'. This will change the background color to black, so that the colors are now easier to see. Now, type 'GOTO 2010' and hit RETURN. You can now enter in new coordinates for your scenes, but note that anything you put now will be in: WHITE or BLACK (background) and one-half the size. This is because you went to HI-RES, without changing all the other parameters. Keep building up multi-scenes without typing 'YES' when you are asked: 'CLEAR SCREEN?'. You may obtain some fascinating results in this way. You may also want to do just the opposite, go from HI-RES (with multi-scenes) to GRAPHICS 39. Then type 'GOTO 2010' (RETURN) and see what happens. Always add 32 to your current GRAPHICS MODE, to get to another mode WITHOUT clearing the screen.

WHERE ARE ALL THE COLORS LOCATED?

When you are in GRAPHICS 8 (or 40) [HI-RES], you may want to change the colors by hitting the 'BREAK' key, and POKEing around as follows: To change the background color, type 'POKE 710,A'. 'A' is the number of the color that you want to POKE into that color. If you want black, 'A' will be '0'. If you want white, 'A' will be '15'. You should experiment with the scale from 0 to 255, to find the color combinations you like. Color registers (locations in memory) vary from 708 to 712, depending on which GRAPHICS mode you are in. When in GRAPHICS 7 (or 39), the background will be 'POKE 712,A'. COLOR 1 will be 'POKE 708,A'. COLOR 2 will be 'POKE 709,A'. And COLOR 3 will be 'POKE 710,A', which previously (in HI-RES) controlled the background. Remember to change these when going from: MODE 2, to MODE 3 (GR.7 to GR.8).

NOTE: The advantage of POKEing these color registers rather than using the SETCOLOR statements is that: POKES are FASTER!! And, much easier to understand than the SETCOLOR statements. They also seem to consume less memory in most instances. HAPPY POKEING AROUND!!!

BREAKDOWN OF PROGRAM #6 AUTO.30

```

1-3      REM STATEMENTS
5        DIM STATEMENTS
10-14    CLEAR SCREEN/RESET VARIABLES/REM ON OVERSCAN ORIGINAL VALUE
15       INPUT OF OVERSCAN (OVS) VALUE
20       INPUT AND RESET VARIABLES FOR RUNNING DEMO MODE
50       PRINT SCREEN RESOLUTION VALUES AND OPTIONS
60       SAME AS ABOVE
70       INPUT SCREEN RS
80-90    RESET VARIABLES FOR SCREEN RESOLUTION CHOSEN
100      INPUT FIELD OF VIEW
105      INPUT AUTO LOOPING or USER INPUT
106-107  INPUT NORMAL SPEED OR OPTION OF 34% FASTER SPEED/RESET VARIABLES
109-120  READ DATA STATEMENTS INTO THE Q(228), R(228), S(228) STRINGS
130-220  DATA FOR THE FIRST OBJECT TO APPEAR ON THE SCREEN
2000     RESET SCREEN FOR USER INPUT
2010-2025 USER INPUT OF LOCATION DATA, COLOR & CLEARING SCREEN MODES
2030     IF 34% FASTER SPEED CHOSEN, PEEK NEEDED VALUES
2035-2040 TRANSFORMATIONS
2050-2090 ACTUAL LOOP FOR PLOTTING THE DATA ON THE SCREEN
2095     IF 34% FASTER SPEED WAS CHOSEN, RESET INTERRUPTS
2100     RETURN FROM ORIGINAL SPOT
2500-2510 MATRIX MULTIPLIER LOOP
2600-2626 LINE PUSHING AND CLIPPING MATRIX
2632-2640 CLIPPING CONTINUED/ CHECK FOR LINE OFF SCREEN
2645-2648 STARTING POINT FOR LINE THAT FALLS OFF THE SCREEN
2655-2658 SAME AS ABOVE BUT FOR END POINT OF LINE
2660-2680 ON OR OFF SCREEN CHECK GOTO's
2694-2706 WHICH DIRECTION TO PUSH THE LINE
2715-2720 PUSH THE POINT TO THE LEFT
2725-2730 PUSH THE POINT TO THE RIGHT
2742-2745 PUSH THE POINT UP
2756-2760 PUSH THE POINT DOWN
2800-2900 SECTION FOR PROJECTING THE LINE ONTO THE SCREEN
3000-3025 READ-IN THE DATA FOR THE SPACE SHUTTLE
3030-4000 DATA FOR X  Q(228)
4010-4090 DATA FOR Y  R(228)
5000-6000 DATA FOR Z  S(228)
6010-6045 DATA FOR THE FOUR VIEWS OF THE SPACE SHUTTLE
6050     RING BELL WHEN FINISHED
6060-6095 STATEMENTS GIVEN AT ENDING OF AUTO LOOP
7000-7995 GOSUB DISPLAY SUBROUTINE/RESET SCREEN/READ IN INTERRUPTS
8000-8060 PRINT DATA FOR AUTO LOOPING
9000-9050 DISPLAY SUBROUTINE
9998-9999 WAIT SUBROUTINES
10000-10060 EACH LINE HAS SEPERATE DATA FOR VIEWS OF OBJECTS IN AUTO MODE
11000-11030 DRAW BORDER FOR OVERSCAN CORRECTION SUBROUTINE
12000-13000 ROTATE COLORS SUBROUTINE

```

NOTE: Main portions of this manual have been printed by using the 'BASIC EDITOR (c) Mini- Word Processor' program by SEBREE'S COMPUTING. This program sells for \$15.95 +\$.75 p&h. Notice how nicely formatted these sections are.

ROTATION OF COLORS

Here is the subroutine used in the DEMO AUTO,3D program to rotate the colors.

```
1200 ? ROTATE the COLORS of your scene in any combination you want!!!
12010 FOR TR=0 TO 30:SETCOLOR 2,8,2:SETCOLOR 1,8,5:SETCOLOR 0,8,8
GOSUB 13000:SETCOLOR 0,8,2:SETCOLOR 2,8,5
12020 SETCOLOR 1,8,8:GOSUB 13000:SETCOLOR 1,8,2:SETCOLOR 0,8,5
SETCOLOR 2,8,8:GOSUB 13000:NEXT TR
12030 POKE 708,40:POKE 709,202:POKE 710,148:POKE 711,70:POKE 712,0:RETURN
13000 FOR PY=0 TO 19:NEXT PY:RETURN
```

You can alter the total effect by changing the colors just a little bit. Whenever you would like to have an option to rotate your colors, just use this subroutine, and GOSUB 12000.

Try putting up a scene in GRAPHICS 7, SCREEN RESOLUTION mode 2, put the scene in all three colors. Now rotate them, and see the wonderful effect you get.

HEAVY TOPIC- MULTI COLORS IN HI-RES MODE

The following program is out on the tape, it is suggested for those of you who are interested in getting more colors in HI-RES mode than the DEFAULT two (foreground & background). It also shows a method of moving your entire graphics page down the screen, to allow for printed material at the top (in 3 colors), and graphics from the center of the screen to the bottom.

It is highly suggested that you study this program and chapter.

Listing

```
2 REM RANGE IS XMAX=159 : YMAX=97
3 REM POKE 87,6 ---PRODUCES A DUPLICATE IMAGE ON THE RIGHT & LEFT SIDES
4 REM POKE 87,9 ---GIVES XMAX=159 , YMAX=159 COLOR (0-8)GIVES DIFFERENT COLORS &
TYPES OF LINES
5 TRAP 120
10 OPEN #3,4,0,"S:"
20 GRAPHICS 8
30 SETCOLOR 2,0,0:POKE 752,3
40 Y=PEEK(561)*256+PEEK(560):FOR X=0 TO 2:POKE Y+136+X,PEEK(Y+199+X):NEXT X
50 II=Y+6:POKE II-3,71:POKE II,7:FOR J=1 TO 6:POKE II+J,6:NEXT J:POKE 87,1
60 ? #6;"THE gRApHic pAgE hAS bEEn mOvEd dOWnWArD tO aIlOW pRinTEd lETtErS aT
the top of the screen ";
61 ? #6;"In- SteAd of the bOtToM.";
62 ? #6;" graphics:"
63 ? #6;" HIRES In 4 COlOrs."
64 GOTO 100
65 POKE 87,7
70 COLOR 2:PLOT 35,6:FOR K=1 TO 10:DRAWTO RND(1)*159,RND(1)*80+7:NEXT K
80 POKE 87,7:COLOR 3:PLOT 35,6:FOR K=0 TO 10:DRAWTO RND(1)*159,RND(1)*80+7:NEXT
K
100 POKE 710,0:FOR A=0 TO 159:POKE 87,7:COLOR RND(1)*5:PLOT A,6:DRAWTO A,RND(1)*
80+7:NEXT A
110 ? CHR$(253):GOTO 70
120 ? CHR$(253):? CHR$(253)
130 GOTO 70
```

Note the upper and lower case letters in lines 60, & 61.

Lines 40 & 50 provide the necessary adjustments for moving the graphics page of memory into this specific location.

Lines 60-63 do the colored printing at the top of the screen. Lines 65 to 100, take care of the graphics.

The secret is in the manipulation of POKE 87. This location in memory has all kinds of odd curiosities about it.

In order to get more colors in HI-RES, you have to fool the ATARI into thinking it is in GRAPHICS 7 mode. You do this by POKEing the location '87' with the value of the graphics mode you are in (assuming GRAPHICS 8) minus one. So PEEK(87) will return an '8' if you are in GRAPHICS 8, this is where we put POKE 87,7. Whichever Graphics mode you are in, the POKE 87,N will change the dimension of the screen. Here is a program listing which has a breakdown of the screen dimensions corresponding to the value in which 87 was POKEd.

```
1 REM LIMITS
5 GRAPHICS 0: ? : ?
10 ? "POKE 87,1 = XMAX=19 , YMAX=23"
20 ? "POKE 87,3 = XMAX=39 , YMAX=23"
30 ? "POKE 87,5 = XMAX=39 , YMAX=47"
40 ? "POKE 87,7 = XMAX=159 , YMAX=95"
50 ? "POKE 87,9 = XMAX=79 , YMAX=191"
```

The above program assumes you are currently in GRAPHICS 8, when you POKE these values

Here is a MOIRE program listing which uses all of these graphics modes

```
1 REM MOIRE
10 MX=79:MY=191:PO=9
20 GOSUB 1000:GOSUB 2000
30 MX=159:MY=95:PO=7
40 GOSUB 1000:GOSUB 2000
50 MX=79:MY=47:PO=5
60 GOSUB 1000:GOSUB 2000
70 MX=39:MY=23:PO=3
80 GOSUB 1000:GOSUB 2000
90 MX=19:MY=23:PO=1
100 GOSUB 1000:GOSUB 2000
990 END
1000 REM
1010 GRAPHICS 24:POKE 710,0
1020 FOR Y=MY TO 0 STEP -1:Q=Y:GOSUB 1400:PLOT 0,Y:DRAWTO MX/2,MY:NEXT Y
1100 FOR X=0 TO MX:Q=X:GOSUB 1400:PLOT X,0:DRAWTO MX/2,MY:NEXT X
1220 FOR Y=0 TO MY:Q=Y:GOSUB 1400:PLOT MX,Y:DRAWTO MX/2+1,MY:NEXT Y:RETURN
1300 FOR X=MX TO 0 STEP -1:Q=X:GOSUB 1400:PLOT X,MY:DRAWTO MX/2,MY/2:NEXT X:RETURN
1370 RETURN
1400 IF Q=125 THEN Q=13
1410 IF Q=155 THEN Q=11
1420 POKE 87,Q:COLOR Q
1430 RETURN
2000 FOR AA=0 TO 1000:NEXT AA:RETURN
```

VERY IMPORTANT NOTE: If you want to move back and forth between modes and still see what was on the screen, in other words, without erasing the screen, just use a GRAPHICS 40, in place of GRAPHICS 8 (ADD 32 to the graphics mode you want to goto). The ATARI will open-up the screen without erasing what was on it !!!

Just follow the examples in the above programs to get your multi-colors on the screen.

When you POKE 87,7 , you will only have the multicolors from the top to the center of the screen. Unless you POKE another value, you will have to make sure that no lines go beyond the center of the screen. There is a way around this as demonstrated in our scribbling program. The software checks to see if the line is below the center of the screen, if it is, the POKE 87,7 is changed back to an '8' and the COLOR is made COLOR 1 (white) and the program continues. When your joystick is above the center of the screen, you have the option of pressing 1,2,3,or 4 on the keyboard to change the color that you are drawing in. Here is a listing of the SCRIBBLING program, note: none of the programs after AUTO.30 are on tape, these are user-experimental programs.

NOTE: SCRIBBLER REQUIRES ONE JOYSTICK.

```

10 GRAPHICS 0: ? "      HIRES SCRIBBLER": GOSUB 600
20 POKE 764,255: ? : ? "      PRESS RETURN TO START"
30 IF PEEK(764)=255 THEN 30
90 OPEN #3,4,0,"S:": B=1
100 GRAPHICS 24: POKE 710,0: POKE 764,255: X=159: Y=100: POKE 87,8
120 JS=STICK(0)
130 POKE 764,255: IF JS=7 OR JS=6 OR JS=5 THEN X=X+1
150 IF JS=11 OR JS=10 OR JS=9 THEN X=X-1: IF X<1 THEN X=1
170 IF JS=14 OR JS=8 OR JS=10 THEN Y=Y-1: IF Y<1 THEN Y=1
180 IF Y<95 THEN POKE 87,7
190 IF JS=13 OR JS=9 OR JS=5 THEN Y=Y+1: IF Y>94 THEN POKE 87,8
200 IF PEEK(764)<>255 THEN 400
210 IF JS=15 THEN 500
220 IF STRIG(0)=0 THEN 250
230 IF PEEK(87)=7 THEN COLOR B: PLOT X/2-1,Y: FOR A2=1 TO 5: NEXT A2: COLOR 0: PLOT X/2-1,Y: GOTO 120
240 COLOR 1: PLOT X,Y: FOR A2=1 TO 5: NEXT A2: COLOR 0: PLOT X,Y: GOTO 120
250 COLOR B: IF PEEK(87)=7 THEN PLOT X/2-1,Y: GOTO 120
260 COLOR 1: PLOT X,Y: GOTO 120
400 P=PEEK(764): IF P=31 THEN B=1
410 IF P=30 THEN B=2
420 IF P=26 THEN B=3
430 IF P=24 THEN B=4
440 IF P=118 OR P=54 THEN 100
450 COLOR B: GOTO 210
500 IF PEEK(87)=7 THEN COLOR B: PLOT X/2-1,Y: COLOR 0: PLOT X/2-1,Y: GOTO 120
510 COLOR 1: PLOT X,Y: COLOR 0: PLOT X,Y: GOTO 120
600 ? " REQUIRES 1 JOYSTICK CONTROLLER."
610 ? " JUST PRESS TRIGGER TO DRAW A SOLID LINE, RELEASING TRIGGER WILL LEAVE A"
620 ? "BLINKING DOT AT THE LOCATION YOU ARE CURRENTLY AT."
630 ? " MOVE JOYSTICK ANY DIRECTION TO MOVE YOUR DRAWING CURSOR."
640 ? " FROM TOP TO CENTER, YOU HAVE 4 COLORSTO DRAW WITH, JUST PRESS 1 THROUGH 4 ON THE KEYBOARD AND WAIT 2 SEC-"
650 ? "ONDS BEFORE RESUMING YOUR SCRIBBLING."
655 ? " NOTE: COLOR 4 IS BLACK (BACKGROUND)"
660 ? " FROM THE CENTER OF THE SCREEN TO THE BOTTOM, YOU HAVE JUST BLACK AND WHITE TO DRAW WITH."
670 ? " PRESS THE CLEAR KEY TO CLEAR SCREEN"
700 RETURN

```

The next two programs are variations of each other, they give an example of the modes type of graphics.


```

0 REM DOUBLES
1 REM RANDOMLY MOVING VECTOR GENERATOR
2 REM BY Tim Hays
3 SETCOLOR 4,5,4:R=0
4 POKE 752,3
5 IF RND(0)*2>1 THEN 70
6 GOTO 70
10 GRAPHICS 8
20 HX=159:HY=95
60 GOTO 80
65 REM
70 GRAPHICS 8:SETCOLOR 2,0,0:R=1:COLOR 1:HX=79:HY=47:POKE 87,5
80 FOR D=1 TO 2
90 A=10*RND(1)-5:B=10*RND(1)-5:A1=10*RND(1)-5:B1=10*RND(1)-5
100 X=HX*RND(1):Y=HY*RND(1)
110 X1=HX*RND(1):Y1=HY*RND(1)
120 COLOR RND(0)*16:T=RND(0)*2
125 FOR C=1 TO 16-(ABS(R-1)*14)
130 IF X>HX OR X<1 OR Y>HY OR Y<1 THEN POP:GOTO 90
140 IF X1>HX OR X1<1 OR Y1>HY OR Y1<1 THEN POP:GOTO 90
145 IF T>1 THEN COLOR RND(8)
150 PLOT X,Y:DRAWTO X1,Y1
160 X=X+A:Y=Y+B:X1=X1+A1:Y1=Y1+B1
170 NEXT C
180 NEXT D
190 RUN
END

```

```

0 REM VIDEO2.ART
1 REM RANDOMLY MOVING VECTOR GENERATOR
2 REM BY Tim Hays
3 SETCOLOR 4,5,4:R=0
4 POKE 752,3
5 IF RND(0)*2>1 THEN 70
6 GOTO 70
10 GRAPHICS 8
20 HX=159:HY=95
60 GOTO 80
65 REM
70 GRAPHICS 24:SETCOLOR 2,0,0:R=1:COLOR 1:HX=79:HY=191:POKE 87,9
80 FOR D=1 TO 3
90 A=10*RND(1)-5:B=10*RND(1)-5:A1=10*RND(1)-5:B1=10*RND(1)-5
100 X=HX*RND(1):Y=HY*RND(1)
110 X1=HX*RND(1):Y1=HY*RND(1)
120 COLOR RND(0)*16:T=RND(0)*2
125 FOR C=1 TO 30-(ABS(R-1)*14)
130 IF X>HX OR X<1 OR Y>HY OR Y<1 THEN POP:GOTO 90
140 IF X1>HX OR X1<1 OR Y1>HY OR Y1<1 THEN POP:GOTO 90
145 IF T>1 THEN COLOR RND(8)
150 PLOT X,Y:DRAWTO X1,Y1
160 X=X+A:Y=Y+B:X1=X1+A1:Y1=Y1+B1
170 NEXT C
180 NEXT D
190 RUN
END

```

Notice the colors and the types of lines being generated.

MIXING TEXT MODES

The very first program, called DISPLAY, had a rather unusual text mode setup to it. This is not hard to learn how to do. The best way to learn about any type of graphics functions on this machine, is to experiment with it. Inside the ATARI lies a set of numbers telling it which graphics mode it is in. This list of numbers change with each new declaration of a graphics mode. There is one number for each graphics row on the screen. In graphics 7+16, there are 96 rows, (96 numbers). these numbers in the list control what graphics mode each row is being displayed in. So it is a simple matter of changing these numbers in the list the correct way to achieve what you want. The only problem is that our new mode has to have a total of 192 scan lines. Exactly.

MODE	0	1	2	3	4	5	6	7	8
NUMBER	66	70	71	72	73	74	75	77	79

Look at the table above. All you have to do is add-up any set of modes which the the NUMBERS total 192. You will have to PEEK into the computer's memory for two locations to tell you where the list of numbers is located.

```
10 A=PEEK(560)+PEEK(561)*254+4
```

The next thing to do is to make a correction if the mode you want on the top of the screen is not the same as the one which consumes the most memory.

```
20 POKE A-1,71
```

Go down the list and change any numbers which need correction to get your mode. These lines are just examples...

```
30 POKE A+2,7:POKE A+3,7
```

Numbers for mode 1 don't need to be changed, they are the default. Line 30 just took care of mode 2.

```
40 FOR B=6 TO 21:POKE A+B,8:NEXT B
```

That just took care of the numbers being corrected for mode 3.

```
50 POKE A+22,65:POKE A+23,PEEK(560):POKE A+24, PEEK(561)
```

Tell the ATARI to go back to the beginning of the list. When designing your own modes, the only changes to be made in line 50 are the numbers 22, 23, 24. these are the 3 row numbers after the last row you used on the screen. HAVE FUN!!!!

Atari 3 - Dimensional Graphics Package

LISTING OF DISPLAY PROGRAM #1

```

4 REM DISPLAY TITLES PROG. FOR 3D GRAPHICS PAC. COPYRIGHT 1980 SEBREE'S
10 GRAPHICS 0:POKE 752,1:J=6+PEEK(742)*256+PEEK(741)
20 SETCOLOR 2,2,4:SETCOLOR 1,2,10:SETCOLOR 0,2,10:SETCOLOR 4,2,4:SETCOLOR 3,6,10
30 POSITION 1,2:? "SEBREE'S COMPUTING":POSITION 26,5:? "PRESENTS"
40 POSITION 4,7:? "3-DIMENSIONAL      COMPUTER GRAPHICS"
50 POSITION 3,17:? "(C) 80 Sebree's Computing-ATARI 800"
60 POKE J+2,7:POKE J+6,6:POKE J+8,6:POKE J+9,7
70 POKE 82,2:POKE 752,0
80 ? CHR$(253):FOR A=1 TO 28
100 POSITION A,9:? "

```

```

"
110 POSITION A,10:? "
120 POSITION A,11:? "

```

} SPECIAL GRAPHICS CHARACTERS

```

"
130 POSITION A,12:? "
140 POSITION A,13:? "
150 POSITION A,14:? "
160 POSITION A,15:? "

```

```

"
170 POSITION A,16:? " ":POKE 53279,0
200 POKE 755,4:FOR B=0 TO 40:NEXT B:POKE 755,0:FOR B=0 TO 32:NEXT B:NEXT A
280 FOR A=1 TO 13:POSITION 1,9:? " ":NEXT A
290 POSITION 3,17:? "(C) 80 Sebree's Computing-ATARI 800"
300 POSITION 8,9:? "Programs in this package:":POSITION 4,11:? "1) DISPLAY Title
s 2) Overscan"
310 ? :? " 3) PYRAMID.3D      4) USER.3D":? :? " 5) CORNERS.3D      5) AUTO.3D
demo":POKE 755,2:CLOAD

```


LISTING OF OVERSCAN CORRECTION PROGRAM #2

```

1 REM CIRCLE (POLYGON) PLOTTER:PROG.2
2 REM OVERSCAN prog. for 3D Graphics Package, Version 8 , 10/2/80
3 REM COPYRIGHT 1980 SEBREE'S : PROG. BY TIM HAYS : ALL RIGHTS RESERVED
4 HZ=159:GRAPHICS 0:POKE 710,0:DIM Y$(3):?
5 ? " CIRCLE (POLYGON) PLOTTER."
10 ? " DRAWS ALL CHORDS WITHIN AN N-GON."
20 ? " USED TO DETERMINE OVERSCAN OF THE MONITOR SO A CIRCLE IS NOT AN ELIPSE
AND A SQUARE IS NOT A RECTANGLE."
30 ? :? "USER INPUTS THE NUMBER OF SIDES OF ANYPOLYGON WITH AN EVEN NUMBER OF SI
DES."
40 ? " MANY-SIDED POLYGONS ARE CLASSIFIED ASCIRCLES, AND WILL LOOK CIRCULAR IN
HIRES.":?
50 ? " ENTER EVEN NUMBER OF SIDES ONLY."
60 TRAP 60: ? CHR$(253):? " NUMBER OF SIDES?":INPUT N:DIM B(N),C(N),H(N)
80 TRAP 80: ? " RADIUS OF PLOT? (HI-RES MAX=154)":INPUT R
85 ? " DIAMETER PLOT ONLY? 'Y'=YES":INPUT Y$:IF Y$(1,1)="Y" THEN CIR=1
86 IF CIR<>1 THEN ? "FANTAIL DISPLAY? 'Y'=YES, 'N'=SPOKES":INPUT Y$:IF Y$(1,1)="
Y" THEN FAN=1
90 P1=6.2831853/N:FLAG=0: ? " GRAPHICS RESOLUTION? (MODE 3-8)":TRAP 90:INPUT GR
92 TRAP 50000
93 OP=32: ? " CLEAR THE SCREEN? 'Y'=YES":INPUT Y$:IF Y$(1,1)="Y" THEN OP=0
94 TRAP 95:GRAPHICS GR+OP
95 FOR A=0 TO 3: ? " " " :NEXT A: ? " COLOR? ALW
AYS '1' FOR HIRES":INPUT CL:COLOR CL
96 NM=PEEK(54288):IR=PEEK(53774):DM=PEEK(54272):POKE 54272,0:POKE 53774,0:POKE 5
4286,0:IF GR=8 THEN POKE 710,0
98 TRAP 50000
100 OUS=.577:REM THIS IS WHERE THE OVERSCAN VARIABLE IS MANIPULATED. THE ORIG
ONAL OUS WAS .577
110 REM THE OVERSCAN VARIABLE ONLY CONTROLS THE 'X' DIRECTION. MAKING OUS SMAL
LER WILL SHORTEN THE WIDTH.
120 REM MAKING OUS LARGER THAN 1.07 WILL MAKE THE FIGURE WIDER.
125 OUS=OUS*.9272097
130 FOR I=1 TO N:B(I)=R+10+R*COS((I-1)*P1):C(I)=R+10+R*SIN((I-1)*P1):NEXT I
135 ? CHR$(253):POKE 54272,DM:POKE 53774,IR:POKE 54286,NM
140 FOR I=1 TO INT(N/2):FOR J=1 TO N:H(J)=0:NEXT J
190 IF I<>N/2 THEN 240
200 FOR J=N/2+1 TO N:H(J)=1:NEXT J
240 J2=1:F=1
250 N1=1
260 IF I=N/2 THEN N1=1
295 IF FLAG=0 THEN PLOT OUS*(B(J2)+HZ)-OUS*HZ,C(J2)/2:SU1=B(J2):SU2=C(J2)
300 FOR J=1 TO N1:J1=J2
320 IF H(J1)=0 THEN 350
330 J1=J1+1:IF J1>N THEN J1=J1-N
340 F=1:GOTO 320
350 J2=J1+1:IF J2>N THEN J2=J2-N
360 J2=J1+1
380 H(J1)=N
400 IF CIR=1 THEN 410
402 IF F=1 THEN PLOT OUS*(B(J1)+HZ)-OUS*HZ,C(J1)/2
410 IF FAN=1 THEN PLOT OUS*(SU1+HZ)-OUS*HZ,SU2/2
420 F=0:FLAG=FLAG+1:DRAWTO OUS*(B(J2)+HZ)-OUS*HZ,C(J2)/2:POKE 53279,0
430 NEXT J:NEXT I:DRAWTO OUS*(SU1+HZ)-OUS*HZ,SU2/2:CLR :DIM Y$(3):GOTO 60
END.

```


LISTING OF PYRAMID.3D PROGRAM #3

```

1 REM PYRAMID.3D Program version 3
2 REM Copyright 1980 SEBREE'S:T.HAYS :ALL RIGHTS RESERVED
10 GRAPHICS 0:LS=8:POKE 710,0
50 POSITION 5,4:? "Screen RESolution?":POSITION 11,5:? "X  ,  Y":POSITION 5,6:?
"1)  80 x 40"
60 POSITION 5,7:? "2) 160 x 80":POSITION 5,8:? "3) 320 x 160 HIRES"
70 INPUT SR:IF SR=1 THEN HZ=39:GP=5:GOTO 100
80 IF SR=2 THEN HZ=79:GP=7:GOTO 100
90 HZ=159:GP=8
100 POSITION 4,11:? "Field of VIEW  .1 Wide—2.0 Small":INPUT U
110 DIM Q(16),R(16),S(16),X(5),Y(5),Z(5),D(8),C$(3):FOR TR=1 TO 16:READ U:Q(TR)=
U:NEXT TR
120 FOR PY=1 TO 16:READ I:R(PY)=I:NEXT PY:FOR PR=1 TO 16:READ E:S(PR)=E:NEXT PR
130 DATA 0,400,400,400,400,0,0,0,0,200,200,0,200,400,400,200
140 DATA 0,0,0,0,0,0,0,0,400,400,0,400,0,0,400
150 DATA 1000,1000,1000,1400,1400,1400,1400,1000,1000,1200,1200,1400,1200,1000,1
400,1200
2000 GRAPHICS GP:SN=0.017453292:POKE 710,0:LA=0:IF GP<>8 THEN POKE 710,148
2010 TRAP 2010:? "VIEWERS LOCATION X,Y,Z":INPUT U,I,E:X(3)=-U:Y(3)=I:Z(3)=-E:TRA
P 2020
2020 ? "Heading, Pitch, & Bank (X,Y,Z)":INPUT H,P,B:P=-P:? "COLOR":INPUT COL:H=-
H:COLOR COL:IF ABS(B)>89 THEN 2020
2025 TRAP 2025:? "CLEAR Screen? YES?":INPUT C$:IF C$(1,1)="Y" THEN GRAPHICS GP:I
F GP=8 THEN POKE 710,0
2030 R6=COS(H*SN):R5=SIN(H*SN):R4=COS(B*SN):R3=SIN(B*SN):R2=COS(P*SN):R1=SIN(P*
SN):L1=R4*R6+R5*R1*R3
2040 L2=-R6*R3+R5*R1*R4:L3=R5*R2*U:L4=R2*R3:L5=R2*R4:L6=-R1*U:L7=-R5*R4+R6*R1*R3
:L8=R5*R3+R1*R4:L9=R2*R6*U
2050 FOR LP=1 TO LS*2-1 STEP 2:X(1)=Q(LP):Y(1)=R(LP):Z(1)=S(LP)
2060 X(5)=Q(LP+1):Y(5)=R(LP+1):Z(5)=S(LP+1):GOSUB 2500
2070 IF LN=0 THEN LA=LA+1:? "LINE of screen window=";LA:GOTO 2090
2080 PLOT X(2)+HZ,(Y(2)+HZ)/2:DRAWTO X(4)+HZ,(Y(4)+HZ)/2
2090 POKE 53279,0:NEXT LP:GOTO 2010
2500 FOR A=1 TO 5 STEP 4:G=X(A)+X(3):S=Y(A)+Y(3):J=Z(A)+Z(3):X(A)=G*L1+S*L4+J*L7
2510 Y(A)=G*L2+S*L5+J*L8:Z(A)=G*L3+S*L6+J*L9:NEXT A
2600 FOR A=1 TO 5 STEP 4:D(A)=0:D(A+1)=0:D(A+2)=0:D(A+3)=0
2610 IF X(A)<=Z(A) THEN D(A)=1
2620 IF X(A)>Z(A) THEN D(A+1)=1
2622 IF Y(A)<=Z(A) THEN D(A+2)=1
2623 IF Y(A)>Z(A) THEN D(A+3)=1
2626 NEXT A
2632 FOR A=1 TO 4:IF D(A)=0 THEN 2640
2636 IF D(A)=D(A+4) THEN 2668
2640 NEXT A
2645 FOR A=1 TO 4:IF D(A)=1 THEN 2675
2648 NEXT A
2655 FOR A=5 TO 8:IF D(A)=1 THEN 2680
2658 NEXT A
2660 LN=1:GOTO 2000
2680 LN=0
2670 RETURN

```


Prog. 3 cont.

```

2675 A=1:S=5:GOTO 2694
2680 A=5:S=1
2694 IF D(A)=1 THEN 2725
2696 IF D(A+1)=1 THEN 2715
2698 IF D(A+2)=1 THEN 2742
2700 IF D(A+3)=1 THEN 2756
2706 GOTO 2660
2715 J=(Z(A)-X(A))/(X(S)-X(A)-Z(S)+Z(A))
2720 X(A)=J*(Z(S)-Z(A))+Z(A):Y(A)=J*(Y(S)-Y(A))+Y(A):Z(A)=X(A):GOTO 2600
2725 J=(Z(A)+X(A))/(X(A)-X(S)-Z(S)+Z(A))
2730 X(A)=J*(Z(A)-Z(S))-Z(A):Y(A)=J*(Y(S)-Y(A))+Y(A):Z(A)=-X(A):GOTO 2600
2742 J=(Z(A)+Y(A))/(Y(A)-Y(S)-Z(S)+Z(A))
2745 X(A)=J*(X(S)-X(A))+X(A):Y(A)=J*(Z(A)-Z(S))-Z(A):Z(A)=-Y(A):GOTO 2600
2756 J=(Z(A)-Y(A))/(Y(S)-Y(A)-Z(S)+Z(A))
2760 X(A)=J*(X(S)-X(A))+X(A):Y(A)=J*(Z(S)-Z(A))+Z(A):Z(A)=Y(A):GOTO 2600
2800 IF Z(1)=0 THEN Z(1)=1.0E-03
2850 IF Z(5)=0 THEN Z(5)=1.0E-03
2860 X(2)=X(1)/Z(1)*HZ:Y(2)=Y(1)/Z(1)*HZ:X(4)=X(5)/Z(5)*HZ:Y(4)=Y(5)/Z(5)*HZ:RET
URN
END

```

LISTING OF USER.3D PROGRAM #4

```

1 REM USER.3D Program version 3
2 REM Copyright 1980 SEBREE'S T.HAYS: All Rights Reserved
10 GRAPHICS 0:POKE 710,0
50 POSITION 5,4:? "Screen RESolution?":POSITION 11,5:? "X   ,   Y":POSITION 5,6:?
"1)   80 x 40"
60 POSITION 5,7:? "2) 160 x 80":POSITION 5,8:? "3) 320 x 160 HIRES"
70 TRAP 70:INPUT SR:IF SR=1 THEN HZ=39:GP=5:GOTO 100
80 IF SR=2 THEN HZ=79:GP=7:GOTO 100
90 HZ=159:GP=8
100 TRAP 100:POSITION 4,11:? "Field of VIEW .1 WIDE—2.0 SMALL":INPUT V
110 TRAP 110:? "HOW MANY LINE SEGMENTS?":INPUT LS:DIM Q(LS*2+1),R(LS*2+1),S(LS*2
+1),X(5),Y(5),Z(5),D(8),C$(3)
115 GRAPHICS 0:? :? "ENTER DATA IN THE FORM OF 'X,Y,Z'":POKE 710,0
120 FOR LP=1 TO LS:? :? "~~~~~":? "LINE # ";LP;
" START PT(X,Y,Z)"
125 TRAP 125:INPUT U,I,E:I=-I
130 TRAP 130:Q(LP*2-1)=U:R(LP*2-1)=I:S(LP*2-1)=E:? :? "END POINT":INPUT U,I,E:I=
-I
140 Q(LP*2)=U:R(LP*2)=I:S(LP*2)=E:NEXT LP
200 OVS=0:? "Want OVERSCAN correction (OVS)? YES?":INPUT C$:IF C$(1,1)="Y" THEN
OVS=0.577
2000 GRAPHICS GP:SN=0.017453292:IF GP=8 THEN POKE 710,0:LA=0:IF OVS THEN GOSUB 1
1000
2010 TRAP 2010:? CHR$(253):? "VIEWERS LOCATION X,Y,Z":INPUT U,I,E:X(3)=-U:Y(3)=I
:Z(3)=-E
2020 TRAP 2020:? "Heading, Pitch, & Bank (X,Y,Z)":INPUT H,P,B:? "COLOR":H=-H:P=-
P:INPUT COL:COLOR COL:IF ABS(B)>89 THEN 2020
2025 TRAP 2025:? "CLEAR Screen? YES?":INPUT C$:IF C$(1,1)="Y" THEN GRAPHICS GP:I
F GP=8 THEN POKE 710,0:IF OVS THEN GOSUB 11000
2030 R6=COS(H*SN):R5=SIN(H*SN):R4=COS(B*SN):R3=SIN(B*SN):R2=COS(P*SN):R1=SIN(P*
N):L1=R4*R6+R5*R1+R3

```


Prog. 4 cont.

```

2040 L2=-R6*R3+R5*R1*R4:L3=R5*R2*U:L4=R2*R3:L5=R2*R4:L6=-R1*U:L7=-R5*R4+R6*R1*R3
  *L8=R5*R3+R1*R4:L9=R2*R6*U
2050 FOR LP=1 TO LS*2-1 STEP 2:X(1)=Q(LP):Y(1)=R(LP):Z(1)=S(LP)
2060 X(5)=Q(LP+1):Y(5)=R(LP+1):Z(5)=S(LP+1):GOSUB 2500
2070 IF LN=0 THEN LA=LA+1:?"LINE OFF SCREEN WINDOW=";LA:GOTO 2090
2078 IF OVS THEN PLOT OVS*(X(2)+HZ)+HZ-OVS*HZ,(Y(2)+HZ)/2:DRAWTO OVS*(X(4)+HZ)+H
  Z-OVS*HZ,(Y(4)+HZ)/2:GOTO 2090
2080 PLOT X(2)+HZ,(Y(2)+HZ)/2:DRAWTO X(4)+HZ,(Y(4)+HZ)/2
2090 POKE 53279,0:NEXT LP:GOTO 2010
2500 FOR A=1 TO 5 STEP 4:G=X(A)+X(3):S=Y(A)+Y(3):J=Z(A)+Z(3):X(A)=G*L1+S*L4+J*L7
2510 Y(A)=G*L2+S*L5+J*L8:Z(A)=G*L3+S*L6+J*L9:NEXT A
2600 FOR A=1 TO 5 STEP 4:D(A)=0:D(A+1)=0:D(A+2)=0:D(A+3)=0
2610 IF X(A)<-Z(A) THEN D(A)=1
2620 IF X(A)>Z(A) THEN D(A+1)=1
2622 IF Y(A)<-Z(A) THEN D(A+2)=1
2623 IF Y(A)>Z(A) THEN D(A+3)=1
2626 NEXT A
2632 FOR A=1 TO 4:IF D(A)=0 THEN 2640
2636 IF D(A)=D(A+4) THEN 2668
2640 NEXT A
2645 FOR A=1 TO 4:IF D(A)=1 THEN 2675
2648 NEXT A
2655 FOR A=5 TO 8:IF D(A)=1 THEN 2680
2658 NEXT A
2660 LN=1:GOTO 2800
2668 LN=0
2670 RETURN
2675 A=1:S=5:GOTO 2694
2680 A=5:S=1
2694 IF D(A)=1 THEN 2725
2696 IF D(A+1)=1 THEN 2715
2698 IF D(A+2)=1 THEN 2742
2700 IF D(A+3)=1 THEN 2756
2706 GOTO 2680
2715 J=(Z(A)-X(A))/(X(S)-X(A)-Z(S)+Z(A))
2720 X(A)=J*(Z(S)-Z(A))+Z(A):Y(A)=J*(Y(S)-Y(A))+Y(A):Z(A)=X(A):GOTO 2600
2725 J=(Z(A)+X(A))/(X(A)-X(S)-Z(S)+Z(A))
2730 X(A)=J*(Z(A)-Z(S))-Z(A):Y(A)=J*(Y(S)-Y(A))+Y(A):Z(A)=-X(A):GOTO 2600
2742 J=(Z(A)+Y(A))/(Y(A)-Y(S)-Z(S)+Z(A))
2745 X(A)=J*(X(S)-X(A))+X(A):Y(A)=J*(Z(A)-Z(S))-Z(A):Z(A)=-Y(A):GOTO 2600
2756 J=(Z(A)-Y(A))/(Y(S)-Y(A)-Z(S)+Z(A))
2760 X(A)=J*(X(S)-X(A))+X(A):Y(A)=J*(Z(S)-Z(A))+Z(A):Z(A)=Y(A):GOTO 2600
2800 IF Z(1)=0 THEN Z(1)=1.0E-03
2850 IF Z(5)=0 THEN Z(5)=1.0E-03
2860 X(2)=X(1)/Z(1)*HZ:Y(2)=Y(1)/Z(1)*HZ:X(4)=X(5)/Z(5)*HZ:Y(4)=Y(5)/Z(5)*HZ:RET
  URN
11000 COLOR 1:IF HZ=159 THEN PLOT 65,0:DRAWTO 65,159:DRAWTO 253,159:DRAWTO 253,0
  :DRAWTO 65,0:RETURN
11010 COLOR COL:IF COL=0 THEN COLOR 1
11020 IF HZ=79 THEN PLOT 32,0:DRAWTO 32,79:DRAWTO 127,79:DRAWTO 127,0:DRAWTO 32,
  0:RETURN
11030 PLOT 16,0:DRAWTO 16,39:DRAWTO 64,39:DRAWTO 64,0:DRAWTO 16,0:RETURN
END

```


LISTING OF CORNERS.3D PROGRAM #5

```

1 REM CORNERS.3D Program version 5
2 REM COPYRIGHT 1980 SEBREE'S,T. HAYS;ALL RIGHTS RESERVED
10 GRAPHICS 0:LS=39:POKE 710,0
50 POSITION 5,4:? "Screen Resolution?":POSITION 11,5:? "X , Y":POSITION 5,6:?
"1) 80 x 40"
60 POSITION 5,7:? "2) 160 x 80":POSITION 5,8:? "3) 320 x 160 HIRES"
70 TRAP 70:INPUT SR:IF SR=1 THEN HZ=39:GP=5:GOTO 100
80 IF SR=2 THEN HZ=79:GP=7:GOTO 100
90 HZ=159:GP=8
100 TRAP 100:POSITION 4,11:? "FIELD OF VIEW .1 WIDE--2.0 SMALL":INPUT U
110 DIM Q(79),R(79),S(79),X(5),Y(5),Z(5),O(8),C$(3):FOR TR=1 TO 78:READ U:Q(TR)=U:NEXT TR
120 FOR PY=1 TO 78:READ I:R(PY)=I:NEXT PY:FOR PR=1 TO 78:READ E:S(PR)=E:NEXT PR
130 DATA -30,-30,-20,-20,-10,-10,0,0,10,10,20,20,30,30,30,-30,30,-30,30,-30,30,-
30,30,-30,30,-30,30,-30
135 DATA -30,30
140 DATA 30,-30,30,-30,30,-30,30,-30,30,-30,30,30,20,20,10,10,0,0,-10,-10,-20,-2
0,-30,-30,0,0,0,0,0,0
150 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
160 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,-10,-10,-20,-20
,-30,-30,-40,-40,-50,-50
170 DATA -60,-60,0,-60,0,-60,0,-60,0,-60,0,-60,0,-60,0,-60,-60,-60,-60,-50,-50,-40,-
40,-30,-30,-20,-20,-10
180 DATA -10,-60,0,-60,0,-60,0,-60,0,-60,0,-60,0,-60,0
190 DATA 100,160,100,160,100,160,100,160,100,160,100,160,100,160,100,110,110
,120,120,130,130,140,140
200 DATA 150,150,160,160,160,160,160,160,160,160,160,160,160,160,160,160,160,160,160,160,160
,160,160,160,160,160,160
210 DATA 160,160,160,160,160,160,100,160,100,160,100,160,100,160,100,160,100,160,100,160,100,160
,100,100,110,110,120,120
220 DATA 130,130,140,140,150,150
400 OVS=0:TRAP 400:? "WANT OVERSCAN CORRECTION (OVS) YES?":INPUT C$:IF C$(1,1)="
Y" THEN OVS=.577
2000 GRAPHICS GP:SN=0.017453292:IF OVS THEN GOSUB 11000:IF GP=8 THEN POKE 710,0
2010 TRAP 2010:? CHR$(253)? "VIEWERS LOCATION X,Y,Z":INPUT U,I,E:X(3)=-U:Y(3)=I
:Z(3)=-E:TRAP 2020
2020 ? "Heading, Pitch, & Bank (X,Y,Z)":INPUT H,P,B:P=-P:H=-H:? "COLOR":INPUT CO
L:COLOR COL:IF ABS(B)>.89 THEN 2020
2025 TRAP 2025:? "CLEAR Screen? YES?":INPUT C$:IF C$(1,1)="Y" THEN GRAPHICS GP:I
F OVS THEN GOSUB 11000:IF GP=8 THEN POKE 710,0
2030 R6=COS(H*SN):R5=SIN(H*SN):R4=COS(B*SN):R3=SIN(B*SN):R2=COS(P*SN):R1=SIN(P*S
N):L1=R4*R6+R5*R1*R3
2040 L2=-R6*R3+R5*R1*R4:L3=R5*R2*U:L4=R2*R3:L5=R2*R4:L6=-R1*U:L7=-R5*R4+R6*R1*R3
:L8=R5*R3+R1*R4:L9=R2*R8*U
2050 FOR LP=1 TO LS*-1 STEP 2:X(1)=Q(LP):Y(1)=R(LP):Z(1)=S(LP)
2060 X(5)=Q(LP+1):Y(5)=R(LP+1):Z(5)=S(LP+1):GOSUB 2500

```


Prog. 5 cont.

```

2070 IF LN=0 THEN LA=LA+1:?"LINE OFF SCREEN WINDOW=";LA:GOTO 2090
2078 IF OUS THEN PLOT OUS*(X(2)+HZ)+HZ-OUS*HZ,(Y(2)+HZ)/2:DRAWTO OUS*(X(4)+HZ)+H
Z-OUS*HZ,(Y(4)+HZ)/2:GOTO 2090
2080 PLOT X(2)+HZ,(Y(2)+HZ)/2:DRAWTO X(4)+HZ,(Y(4)+HZ)/2
2090 POKE 53279,0:NEXT LP:GOTO 2010
2500 FOR A=1 TO 5 STEP 4:G=X(A)+X(3):S=Y(A)+Y(3):J=Z(A)+Z(3):X(A)=G*L1+S*L4+J*L7
2510 Y(A)=G*L2+S*L5+J*L8:Z(A)=G*L3+S*L6+J*L9:NEXT A
2600 FOR A=1 TO 5 STEP 4:D(A)=0:D(A+1)=0:D(A+2)=0:D(A+3)=0
2610 IF X(A)<-Z(A) THEN D(A)=1
2620 IF X(A)>Z(A) THEN D(A+1)=1
2622 IF Y(A)<-Z(A) THEN D(A+2)=1
2623 IF Y(A)>Z(A) THEN D(A+3)=1
2626 NEXT A
2632 FOR A=1 TO 4:IF D(A)=0 THEN 2640
2636 IF D(A)=D(A+4) THEN 2668
2640 NEXT A
2645 FOR A=1 TO 4:IF D(A)=1 THEN 2675
2648 NEXT A
2655 FOR A=5 TO 8:IF D(A)=1 THEN 2680
2658 NEXT A
2660 LN=1:GOTO 2800
2668 LN=0
2670 RETURN
2675 A=1:S=5:GOTO 2694
2680 A=5:S=1
2684 IF D(A)=1 THEN 2725
2696 IF D(A+1)=1 THEN 2715
2698 IF D(A+2)=1 THEN 2742
2700 IF D(A+3)=1 THEN 2756
2706 GOTO 2660
2715 J=(Z(A)-X(A))/(X(S)-X(A)-Z(S)+Z(A))
2720 X(A)=J*(Z(S)-Z(A))+Z(A):Y(A)=J*(Y(S)-Y(A))+Y(A):Z(A)=X(A):GOTO 2600
2725 J=(Z(A)+X(A))/(X(A)-X(S)-Z(S)+Z(A))
2730 X(A)=J*(Z(A)-Z(S))-Z(A):Y(A)=J*(Y(S)-Y(A))+Y(A):Z(A)=-X(A):GOTO 2600
2742 J=(Z(A)+Y(A))/(Y(A)-Y(S)-Z(S)+Z(A))
2745 X(A)=J*(X(S)-X(A))+X(A):Y(A)=J*(Z(A)-Z(S))-Z(A):Z(A)=-Y(A):GOTO 2600
2756 J=(Z(A)-Y(A))/(Y(S)-Y(A)-Z(S)+Z(A))
2760 X(A)=J*(X(S)-X(A))+X(A):Y(A)=J*(Z(S)-Z(A))+Z(A):Z(A)=Y(A):GOTO 2600
2800 IF Z(1)=0 THEN Z(1)=1.0E-03
2850 IF Z(5)=0 THEN Z(5)=1.0E-03
2860 X(2)=X(1)/Z(1)*HZ:Y(2)=Y(1)/Z(1)*HZ:X(4)=X(5)/Z(5)*HZ:Y(4)=Y(5)/Z(5)*HZ:RET
URN
11000 COLOR 1:IF HZ=159 THEN PLOT 65,0:DRAWTO 65,159:DRAWTO 253,159:DRAWTO 253,0
:DRAWTO 65,0:RETURN
11010 COLOR COL:IF COL=0 THEN COLOR 1
11020 IF HZ=79 THEN PLOT 32,0:DRAWTO 32,79:DRAWTO 127,79:DRAWTO 127,0:DRAWTO 32,
0:RETURN
11030 PLOT 16,0:DRAWTO 16,39:DRAWTO 64,39:DRAWTO 64,0:DRAWTO 16,0:RETURN
END

```


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This version of AUTO.3D has been 'HASHED', that is, compacted to use the least amount of memory as possible. You will notice some drastic changes from the style of the first 3 Three-D programs. Numeric constants-- numbers that are used more than twice in the program, have been assigned to a variable. This variable uses only 1 BYTE for the number '1234' rather than 4 BYTES. This mashing process saved about 3.4K of memory in this program!!!

LISTING OF PROGRAM #6- AUTO.3D Demo program

```

1 REM AUTO.3D PROGRAM VERSION 23.68 :Copyright '80 & '81 SEBREE'S COMPUTING:TIM
  HAYS- Programmer; Update- 3/24/81
2 REM SEBREE'S COMPUTING: 456 Granite Ave.: Monrovia, CA. 91016; Phone num. (213
  )- 359-8092 : All Rights Reserved.
3 Q0=3000:Q1=1:Q2=0:Q4=4:Q5=5:Q6=3:Q7=8000:Q8=8:Q9=6:Q10=7:Q12=9:Q13=10:Q14=2:Q1
  6=16:Q17=17:Q18=2010:Q20=0.017453292:Q21=11000
4 Q22=2020:Q23=1.0E-03:Q27=0.497:Q28=20:Q32=2030:Q36=2035:Q38=3000:Q39=39:Q41=40
  :Q42=30:Q44=15:Q47=25:Q49=32:Q50=50:Q51=13000
5 Q55=55:Q61=60:Q64=64:Q65=65:Q70=70:Q78=78:Q79=79:Q80=80:Q87=87:Q90=2090:Q91=90
  :Q100=100:Q106=106:Q127=127:Q148=148:Q159=159
6 Q200=200:Q228=228:Q253=253:Q272=54272:Q286=54286:Q600=2600:Q710=710:Q755=755:Q
  774=53774:Q998=9998:Q999=9999
9 DIM Q(228),R(228),S(228),X(5),Y(5),Z(5),D(8),C$(4):M9=Q1:GOSUB Q0
10 REM INITIALIZE
12 GRAPHICS Q2:POKE Q710,Q2:LS=Q39:LA=Q2:? ">AUTO.3D Prog. vrsn. 18.E":? "NOTE:3
  2K REQUIRED for >HI-RES<."
15 QVS=Q2:? "WANT OVERSCAN (QVS) CORRECTION? YES?":INPUT C$:IF C$(Q1,Q1)="Y" THE
  N QVS=0.577
20 ? " Want to run DEMO MODE? YES?":INPUT C$:IF C$(Q1,Q1)="Y" THEN SR=Q6:HZ=Q159
  :6P=Q8:T=Q1:K=Q7:GOTO Q106
50 POSITION Q5,Q3:? "Screen RESolution?":POSITION 11,Q10:? "% . Y":POSITION Q5
  ,Q8:? "1) 80 x 40"
60 POSITION Q5,Q12:? "2) 160 x 80":POSITION Q5,Q13:? "3) 320 x 160 HIRES"
70 TRAP Q70:INPUT SR:IF SR=Q1 THEN HZ=Q39:6P=Q5:GOTO Q100
80 IF SR=Q14 THEN HZ=Q79:6P=Q10:GOTO Q100
90 HZ=Q159:6P=Q8:IF SR<>Q6 THEN GOTO Q50
100 TRAP Q100:POSITION Q4,Q13:? "FIELD OF VIEW (.1 WIDE -- 2.0 SMALL)":INPUT V
105 TRAP 105:POSITION Q4,Q16:? "1) AUTOMATIC LOOPING":POSITION Q4,Q17:? "2) USER
  INPUT":INPUT T:K=Q13:IF T=Q1 THEN K=Q7
106 ? "Visible processing (1), or non-visibleprocessing at 34% faster speed (2)"
:INPUT PX:IF PX>Q14 THEN GOTO Q106
107 IF T=Q1 THEN V=0.5:GOTO K-Q13
109 ? " GETTING DATA..."
110 LS=Q39:FOR TR=Q1 TO Q78:READ U:Q(TR)=U:NEXT TR
120 FOR PY=Q1 TO Q78:READ I:R(PY)=I:NEXT PY:FOR PR=Q1 TO Q78:READ E:S(PR)=E:NEXT
  PR
130 DATA -30,-30,-20,-20,-10,-10,0,0,10,10,20,20,30,30,30,-30,30,-30,30,-30,30,-
  30,30,-30,30,-30,30,-30,-30,30
140 DATA 30,-30,30,-30,30,-30,30,-30,30,30,20,20,10,10,0,0,-10,-10,-20,-2
  0,-30,-30,-30,-30,-30
150 DATA -30,-30,-30,-30,-30,-30,-30,-30,-30,-30,-30,-30,-30,-30,-30,-30,-30
  ,-30,-30,-30
160 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,-10,-10,-20,-20
  ,-30,-30,-40,-40,-50,-50
170 DATA -60,-60,0,-60,0,-60,0,-60,0,-60,0,-60,0,-60,0,-60,-60,-60,-50,-50,-40,-
  40,-30,-30,-20,-20,-10
180 DATA -10,-60,0,-60,0,-60,0,-60,0,-60,0,-60,0
190 DATA 100,160,100,160,100,160,100,160,100,160,100,160,100,160,100,160,100,160
  ,120,120,130,130,140,140
200 DATA 150,150,160,160,160,160,160,160,160,160,160,160,160,160,160,160,160,160
  ,160,160,160,160,160
210 DATA 160,160,160,160,160,160,100,160,100,160,100,160,100,160,100,160,100,160
  ,100,100,110,110,120,120
220 DATA 130,130,140,140,150,150

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```

230 IF T=Q1 THEN RETURN
2000 GRAPHICS GP:SN=Q20:POKE Q710,Q2:LA=Q2:IF OVS THEN GOSUB Q21:IF GP<>Q8 THEN
POKE Q710,Q148
2010 TRAP Q18:? CHR$(Q253):? "VIEWERS LOCATION X,Y,Z":INPUT U,I,E:X(Q6)=-U:Y(Q6)
=I:Z(Q6)=-E:TRAP Q22
2020 ? "Heading, Pitch, & Bank (X,Y,Z) ":INPUT H,P,B:P=-P:? "COLOR":H=-H:INPUT C
OL:COLOR COL:IF ABS(B)>89 THEN GOTO Q22
2025 TRAP 2025:? "CLEAR screen? YES?":INPUT C$:IF C$(Q1,Q1)="Y" THEN GRAPHICS GP
:IF OVS THEN GOSUB Q21
2027 POKE Q710,Q2:IF GP<>Q8 THEN POKE Q710,Q148
2030 IF PX=Q14 THEN NM=PEEK(Q286):IR=PEEK(Q774):DM=PEEK(Q272):POKE Q272,Q2:POKE
Q774,Q2:POKE Q286,Q2
2035 R6=COS(H*SN):R5=SIN(H*SN):R4=COS(B*SN):R3=SIN(B*SN):R2=COS(P*SN):R1=SIN(P*
N):L1=R4*R6+R5*R1*R3
2040 L2=-R6*R3+R5*R1*R4:L3=R5*R2*U:L4=R2*R3:L5=R2*R4:L6=-R1*U:L7=-R5*R4+R6*R1*R3
:L8=R5*R3+R1*R4:L9=R2*R6*U
2050 FOR LP=Q1 TO L3*Q14-Q1 STEP Q14:X(Q1)=Q(LP):Y(Q1)=R(LP):Z(Q1)=S(LP):POKE 77
,Q2
2060 X(Q5)=Q(LP+Q1):Y(Q5)=R(LP+Q1):Z(Q5)=S(LP+Q1):GOSUB 2500
2070 IF LN=Q2 THEN LA=LA+Q1:? "LINE OFF SCREEN WINDOW = ":LA:GOTO Q90
2075 IF P1=10030 THEN POKE Q710,Q148:COLOR INT(Q6*RND(Q1)+Q1)
2078 IF OVS THEN PLOT (OVS*(X(Q14)+HZ)+HZ-OVS*HZ)*M9,(Y(Q14)+HZ)/Q14:DRAWTO (OVS
*(X(Q4)+HZ)+HZ-OVS*HZ)*M9,(Y(Q4)+HZ)/Q14:GOTO Q90
2080 PLOT (X(Q14)+HZ)*M9,(Y(Q14)+HZ)/Q14:DRAWTO (X(Q4)+HZ)*M9,(Y(Q4)+HZ)/Q14
2090 POKE 53279,Q2:RN=RN+Q1:? "LINE #":RN:NEXT LP:IF P1>10060 THEN GOTO P2
2095 IF X=Q18 AND PX=Q14 THEN POKE Q272,DM:POKE Q774,IR:POKE Q286,NM
2100 GOTO K
2500 FOR A=Q1 TO Q5 STEP Q4:G=X(A)+X(Q6):S=Y(A)+Y(Q6):J=Z(A)+Z(Q6):X(A)=G*L1+S*L
4+J*L7
2510 Y(A)=G*L2+S*L5+J*L8:Z(A)=G*L3+S*L6+J*L9:NEXT A
2600 FOR A=Q1 TO Q5 STEP Q4:D(A)=Q2:D(A+Q1)=Q2:D(A+Q14)=Q2:D(A+Q6)=Q2:IF X(A)<-Z
(A) THEN D(A)=Q1
2620 IF X(A)>Z(A) THEN D(A+Q1)=Q1
2622 IF Y(A)<-Z(A) THEN D(A+Q14)=Q1
2623 IF Y(A)>Z(A) THEN D(A+Q6)=Q1
2626 NEXT A:FOR A=Q1 TO Q4:IF D(A)=Q2 THEN 2640
2636 IF D(A)=D(A+Q4) THEN 2668
2640 NEXT A:FOR A=Q1 TO Q4:IF D(A)=Q1 THEN 2675
2648 NEXT A:FOR A=Q5 TO Q8:IF D(A)=Q1 THEN 2680
2658 NEXT A
2660 LN=Q1:GOTO 2800
2668 LN=Q2:RETURN
2675 A=Q1:S=Q5:GOTO 2694
2680 A=Q5:S=Q1
2694 IF D(A)=Q1 THEN 2725
2696 IF D(A+Q1)=Q1 THEN 2715
2698 IF D(A+Q14)=Q1 THEN 2742
2700 IF D(A+Q6)=Q1 THEN 2756
2706 GOTO 2660
2715 J=(Z(A)-X(A))/(X(S)-X(A)-Z(S)+Z(A)):X(A)=J*(Z(S)-Z(A))+Z(A):Y(A)=J*(Y(S)-Y
(A))+Y(A):Z(A)=X(A):GOTO Q600
2725 J=(Z(A)+X(A))/(X(A)-X(S)-Z(S)+Z(A)):X(A)=J*(Z(A)-Z(S))-Z(A):Y(A)=J*(Y(S)-Y
(A))+Y(A):Z(A)=-X(A):GOTO Q600
2742 J=(Z(A)+Y(A))/(Y(A)-Y(S)-Z(S)+Z(A)):X(A)=J*(X(S)-X(A))+X(A):Y(A)=J*(Z(A)-Z
(S))-Z(A):Z(A)=-Y(A):GOTO Q600
2756 J=(Z(A)-Y(A))/(Y(S)-Y(A)-Z(S)+Z(A)):X(A)=J*(X(S)-X(A))+X(A):Y(A)=J*(Z(S)-Z
(A))+Z(A):Z(A)=Y(A):GOTO Q600
2800 IF Z(Q1)=Q2 THEN Z(Q1)=Q23
2850 IF Z(Q5)=Q2 THEN Z(Q5)=Q23
2860 X(Q14)=X(Q1)/Z(Q1)*HZ:Y(Q14)=Y(Q1)/Z(Q1)*HZ:X(Q4)=X(Q5)/Z(Q5)*HZ:Y(Q4)=Y(Q5
)/Z(Q5)*HZ:RETURN

```


[illegible]


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6050 ? CHR$(Q253):? CHR$(Q253):GOSUB Q999:GOSUB Q999
6060 GRAPHICS Q2:POKE Q710,Q2:?:?:? "MOVEBACKANDFORTHBETWEENGRAPHICSANDTEXT":F
OR Q=Q1 TO 500:NEXT Q:FOR Q1=Q2 TO Q6
6065 POSITION Q1,23:?"Use more colors in HI-RES !!!"
6070 GRAPHICS Q41:POKE Q710,Q2:FOR Q=Q2 TO 170:NEXT Q:GRAPHICS Q2:POKE Q710,Q2:?:?:?
6080 ? "SAVE YOUR TEXT WINDOWS !!! !!!":FOR Q=Q2 TO 150:NEXT Q:NEXT Q1
6090 RESTORE :GRAPHICS Q2:POKE Q710,Q2:?:?:? "THE AUTO PROGRAM LOOP IS COMPLET
ED AS OF NOW, IT SHALL CONTINUE TO RUN."
6095 ? CHR$(Q253):FOR Q=Q2 TO 450:NEXT Q
7000 GOSUB Q0
7990 GRAPHICS GP:POKE Q710,Q2:SN=Q20:P1=10000:GOSUB 110:V=0.4:P2=Q38
7995 DM=PEEK(Q272):IR=PEEK(Q774):NM=PEEK(Q286)
8000 ? CHR$(Q253):? "VIEWERS LOCATION X,Y,Z":GOSUB Q998:GOSUB P1:?"?":X(Q6):?",":
Y(Q6):?",":Z(Q6)
8005 IF PX=Q14 THEN POKE Q272,DM:POKE Q774,IR:POKE Q286,NM:?" CHR$(Q253):GRAPHICS
Q41:POKE Q710,Q2:?" CHR$(Q253)
8007 IF B=-Q42 THEN GRAPHICS Q39:GOSUB 12000
8010 ? "HEADING, PITCH, & BANK":GOSUB Q998:?"?":H:?",":P:?",":B:RN=Q2
8020 ? "COLOR":GOSUB Q998:?"?":?"?":?"CLEAR screen? YES?":GOSUB Q998:?"YES":P1=P1
+Q13:IF P1>10070 THEN GOTO Q38
8040 GOSUB Q999:GRAPHICS 6P:IF QVS THEN GOSUB Q21
8050 IF 6P=Q8 THEN POKE Q710,Q2
8060 GOTO Q32
9000 ? CHR$(Q253):GRAPHICS Q2:Q=Q9+PEEK(742)*256+PEEK(741):SETCOLOR Q14,Q14,Q4:S
ETCOLOR Q1,Q14,Q13
9010 SETCOLOR Q2,Q14,Q44:SETCOLOR Q4,Q9,Q16:POKE Q710,113:POSITION Q1,Q14:?"SEB
REE'S COMPUTING":POSITION 26,Q5:?"PRESENTS"
9020 POSITION Q4,Q10:?"3-DIMENSIONAL COMPUTER GRAPHICS":POSITION Q6,Q17:?"
(C)'80 Sebree's Computing-ATARI 800"
9030 POKE Q+Q14,Q10:POKE Q+Q3,Q9:POKE Q+Q3,Q3:POKE Q+Q12,Q10:POSITION Q14,Q13
9040 ? CHR$(Q253):FOR Q=Q1 TO Q5:FOR A1=Q1 TO Q55:NEXT A1:POKE Q755,255:FOR A=Q1
TO Q61:NEXT A:POKE Q755,Q2:NEXT Q
9050 SETCOLOR Q14,Q4,Q44:SETCOLOR Q4,Q4,Q44:SETCOLOR Q2,Q14,Q16:FOR A=Q1 TO Q200
:NEXT A:RETURN
9998 FOR A=Q1 TO 120:NEXT A:RETURN
9999 ? "PLOT FINISHED, & CONTINUING":FOR A=Q1 TO Q200:NEXT A:RETURN
10000 X(Q6)=-Q91:Y(Q6)=Q70:Z(Q6)=Q2:P=-Q28:B=Q55:H=-Q42:COLOR Q1:RETURN
10010 X(Q6)=Q2:Y(Q6)=Q42:Z(Q6)=Q2:P=Q2:B=Q61:H=Q2:RETURN
10020 X(Q6)=-95:Y(Q6)=Q70:Z(Q6)=Q2:P=-Q13:B=-Q55:H=-Q42:GP=Q10:HZ=Q79:RETURN
10030 X(Q6)=Q2:Y(Q6)=Q42:Z(Q6)=Q2:P=Q2:B=-Q42:H=Q2:GP=Q8:HZ=Q159:COLOR Q1:RETURN

10040 X(Q6)=-Q61:Y(Q6)=-Q50:Z(Q6)=Q2:P=Q47:B=Q61:H=-45:RETURN
10050 X(Q6)=Q2:Y(Q6)=Q42:Z(Q6)=Q2:P=Q2:B=Q2:H=Q2:RETURN
10060 X(Q6)=-Q91:Y(Q6)=Q70:Z(Q6)=Q2:P=-Q28:B=-Q55:H=-Q47:RETURN
11000 COLOR Q1:IF HZ=Q159 THEN PLOT Q65,Q2:DRAWTO Q65,Q159:DRAWTO Q253,Q159:DRAW
TO Q253,Q2:DRAWTO Q65,Q2:RETURN
11010 COLOR COL:IF COL=Q2 THEN COLOR Q1
11020 IF HZ=Q79 THEN PLOT Q49,Q2:DRAWTO Q49,Q79:DRAWTO Q127,Q79:DRAWTO Q127,Q2:D
RAWTO Q49,Q2:RETURN
11030 PLOT Q16,Q2:DRAWTO Q16,Q39:DRAWTO Q64,Q39:DRAWTO Q64,Q2:DRAWTO Q16,Q2:RETU
RN
12000 ? "ROTATE the COLORS of your scene in anycombination you want!!!"
12010 FOR TR=Q2 TO Q42:SETCOLOR Q14,Q8,Q14:SETCOLOR Q1,Q8,Q5:SETCOLOR Q2,Q8,Q8:G
OSUB Q51:SETCOLOR Q2,Q8,Q14:SETCOLOR Q14,Q8,Q5
12020 SETCOLOR Q1,Q8,Q8:GOSUB Q51:SETCOLOR Q1,Q8,Q14:SETCOLOR Q2,Q8,Q5:SETCOLOR
Q14,Q8,Q8:GOSUB Q51:NEXT TR
12030 POKE 708,Q41:POKE 709,282:POKE Q710,Q148:POKE 711,Q70:POKE 712,Q2:RETURN
13000 FOR PY=Q2 TO 19:NEXT PY:RETURN

```


>>>GRAPHICS EDITOR!!<<< ATARI 800
16K min. 40K Preferred. NOW, both 2-D and 3-D scenes can be designed with a JOYSTICK, and then saved to disk!! These scenes can then be loaded in later to be edited before you save it again under another name!! All of this can be done using ANY graphics mode! But that's not all!!! You can save entire screens OR just individual images in 2-D or 3-D!! You have the option of giving the new scenes different file names, a MENU of disk file names is shown on the screen as you choose the file name. A HELP option is included should you have any trouble with ANY operation. If you decide to use the 3-D option, you may change the 3-D view(s) of the object(s) on the screen. Uses Player-Missile-Graphics for the fast acting 'Cursor'. POWERFUL, and WELL DOCUMENTED!! DISK version is recommended. (--add \$5.00--). With 5 programs. Only \$29.95 + \$1.50 p&h on cassette.

>>TRS-80 COLOR COMPUTER EXTENDED BASIC >>3-D C.C. GRAPHICS PACKAGE!!<< NOW,
you can get our popular 3-D Graphics Package for your 16K COLOR COMPUTER!!! Design you own graphics with a joystick & view these images from any angle you want!! software selectable Screen Resolutions, Colors, Viewing angles, Rotation, Object erase & replacement, Wide-angle or Telephoto views, along with ALL of the required 3-D operations to change the viewers location. WITH MANUAL AND LISTINGS!! ONLY \$24.95 + \$1.50 p&h. on cassette.

SEBREE'S COMPUTING PRESENTS

SOFTWARE FOR THE ATARI 400/800 PERSONAL COMPUTER.

*Atari 800**
Software

SEBREE'S COMPUTING:
456 Granite Ave.
Monrovia, Ca 91016
Phone- (213)-359-8092

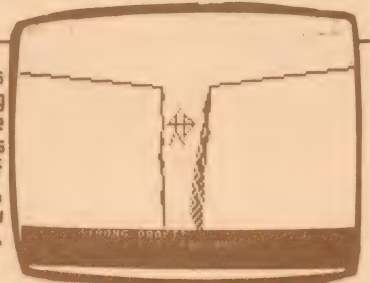
*Atari 800**
Software

WHEN ORDERING, BE SURE TO INDICATE- PROGRAMS FOR 'ATARI' COMPUTER

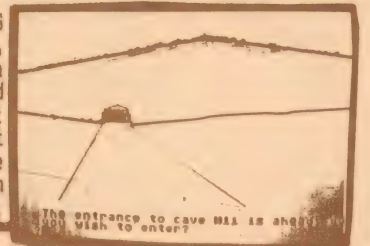
All programs are supplied on tape unless otherwise specified. A operation manual is supplied with each program along with FULL LISTINGS of the programs!!! The photographs below were taken from the actual programs to give you a visual idea of what the program is like, however, the colors had to be changed for photographic purposes, the colors may be entirely reversed. The memory requirements have been listed in front of each program, this is the absolute minimum, some programs (DOWN THE TRENCH, for example) have many versions included on the tape, so a particular version of a program you want to use MAY require more memory than specified. NOTE: Updated programs are made from time to time. We will send you an updated tape at a low cost of \$3.00, (for postage and duplication costs) when you RETURN the ORIGINAL program tape.

TO HAVE YOUR PROGRAM(S) PUT ON A DISKETTE, ENCLOSE \$5.00 EXTRA.

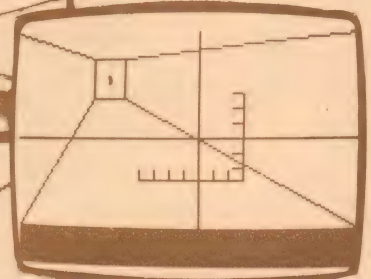
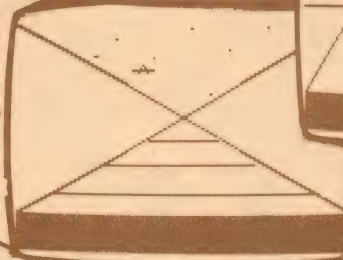
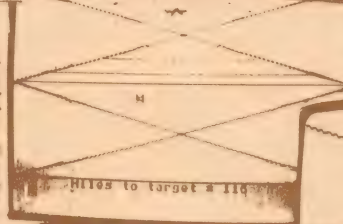
16K WUMPUS ADVENTURE: This is a VERY dynamic version of the popular game 'WUMPUS'. There is the addition of graphics and sound effects!!! The program takes up all of the 16K memory. The playing field is very alive with deadly CAVE SNAKES, SUPER BATS which are hard to see in the dim light of the caverns, and other assorted hazards you would expect to find in a caverns. The object of the game is to search through a maze of caverns for the mythical 'WUMPUS'. The WUMPUS is very hard to find and, of course, can move himself and possibly attack YOU!! There are many things to be careful of in a caverns, hazards abound everywhere. To catch the WUMPUS, you must shoot him with one of your 3 arrows, or throw a rock at him to knock him out, but throwing rocks are not very accurate (if you run out of arrows). Beware of the WUMPUS, he may decide to have you for lunch!!! Only- \$14.95 +.95 p&h.



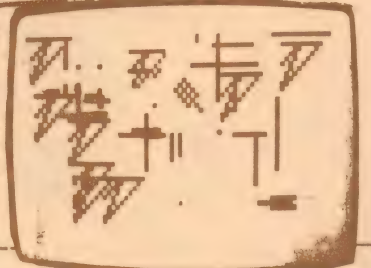
24K WUMPUS ADVENTURE- EXPANDED VERSION! This game is a much expanded version of the 16K WUMPUS ADVENTURE above!! The graphics are all done in HI-Resolution in multi-colors!!! Enhanced sound effects, along with an extra 8K more of hazards and surprises!! This game is much more like an ADVENTURE than a WUMPUS!! There are graphic CAVE-INS, KILLER DWARVES, SNEAKY CAVE TROLLS (they steal your arrows and supplies), options on entering certain cave numbers at the start of the game, and a snake bite kit available. The graphic illustrations are much better than before. The cavern set-up is always different at the start of the game, but you have the option of playing the same setup as before if you somehow are killed early in the game. There are possibilities of finding an arrow left by a previously eaten explorer, and finding throwing rocks when you are out of arrows. When you finally do get the WUMPUS, the musical theme from the olympics is played just for you! Only- \$17.95 +.95 p&h.



8K & 16K & 24K DOWN THE TRENCH: This is one of our best selling- most popular game programs!!! It is a set of 2 programs that include 8K, 16K, and 24K versions!! The second program has the options in it for 16K or 24K operation (HI-RES in multi-colors!!). The theme of these programs is to keep yourself from getting hit from a laser post while flying your space-craft down the TRENCH of the dreaded DEATH STAR!! The 24K version includes DARTH VADER on your tail (shown on the AFT VIEW) trying to shoot you down, DO NOT STAY STILL!! You have to fly through this mess of LASER fire until you near your target, the exhaust port. This is where your on-board attack computer engages itself and you have to line-up your target and fire at the right moment, pull your ship up and out of the TRENCH and away from the DEATH STAR, and watch it destroy itself (if your shot was accurate!!) NOTE: This program set is definitely NOT the same as the one published in SOFTSIDE (tm), as this set is VERY much expanded and enhanced!! Requires 1 Joystick. Only- \$16.95 +.95 p&h.



8K BATTLING TANKS: This is a two player TANK battle game that uses graphics in a unique way so that the TANKS go different speeds over different terrain. If your tank is fired upon, you still have time to move while the shot is advancing. If your shot runs into an obstacle, it harmlessly explodes! The rotation matrix is extremely fast! The graphics are fast enough to swear it is almost real-time!! But, remember, TANKS don't move very fast anyway. You have the option of setting the maximum score at the start of the game, and the computer shows the score at regular intervals, and shows who is the winner at the finish. This another one of our VERY popular graphics games!! The game requires TWO joysticks and TWO human players. Only- \$9.95 +.95 p&h.



SOFTWARE FOR
THE- 'ATARI 800'

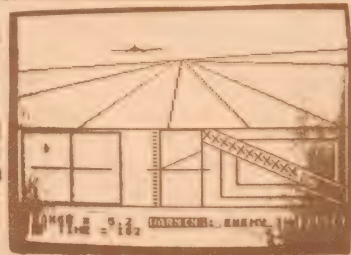
Atari 800

Software

Software

SEBREE'S COMPUTING SOFTWARE FOR THE ATARI* Continued

16K 3-D RED BARON DOGFIGHT/ FLIGHT SIMULATOR!! The title practically speaks for itself! This is one of our best selling games that requires that you learn to fly before you DOGFIGHT! The graphics are superb, all done in the HI-RESolution mode in multi- colors!!! The sound effects are very realistic, and the overall capabilities are very fun to learn. Entirely programmed in BASIC but executes quite fast. The program will only re-fresh (re-draw) that part of the screen that requires it, so screen refreshing changes from SIX cycles per second to 2.25 cycles per second. This is an updated version (updated on 3/26/81) expanded. You are flying behind the RED BARON, but catching up to him. If you don't line him up and shoot him down soon, his tail-gunner will start shooting at you! But remember, his craft doesn't stay stationary! A RADAR, ALTIMETER & BANKING METER, and number of wins continually shown at the bottom. Requires 1 joystick, and one human pilot. Only-- \$16.95 +.95 p&h.



8K & 16K PROGRAM SAMPLER #1: This set of programs is a nice way to see the quality of our programs at a low price. There are FOUR (4) programs in this package!! Programs are: EXOTIC CIRCLE PLOTTER, generates a wide variety of outputs in a variety of types and colors of circles. CRASH COURSE, try to keep your speeding car within the boundaries of the road by using your joystick and get the highest mileage, then try pressing your trigger and going into OVERDRIVE!! HI-RES SCRIBBLER, uses one player with a joystick to allow you to draw anything you want on the screen --from 1 to 4 (FOUR!) COLORS! VIDEO MOIRE, a graphic program where the ATARI will display a MOIRE pattern in a variety of different modes, all HI-RES in 4 colors!! Also includes a RANDOM VECTOR GENERATOR within the same program. This GENERATOR puts up some interesting designs using non-standard line drawing techniques. A good value! Requires 1 joystick for two of the programs. >>> ONLY!-- \$9.95 +.95 p&h.

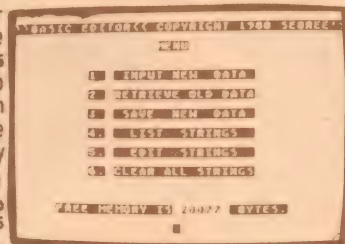


8K SUBMARINE MINEFIELD navigator: This game can be played by one OR two players using joysticks! You will have to move through a VERY dense minefield with moving depthcharges traveling all around you! Then, to make matters worse, a RADAR- SEARCH team appears in a boat above you. If their radar finds you, they will destroy your ship with a laser!! The object of the game is to navigate your submarine through the minefield and other obstacles to get to the right side of the playfield first, in the least amount of time. Your submarines have full up- down- forward- reverse maneuverability. The computer will keep score from one game to the next and total the scores at the end of each round, showing the winner when you have completed the number of rounds you specified at the beginning of the game. Requires two joysticks, and two human navigators. Only-- \$9.95 +.95 p&h.

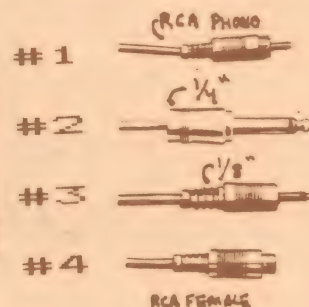


8K & 16K BALLOON POP & PYLON RACER: This is a set of programs in which you are flying a radio- controlled plane. In BALLOON POP, you try to run into and pop as many balloons as you can. As your plane goes off the screen on the right side, (where the flying balloons are) it appears again on the left. In PYLON RACER, you have to complete the 10 laps around the track, without running into any other planes, the ground, a pylon, or a flag- holder!! These programs are tailored after the actual AMA (American Modelers Association) competition rules!! BALLOON POP requires 8K RAM and 1 joystick. PYLON RACER requires 16K RAM and 1 joystick. PYLON RACER includes 2 views of the playfield, to simulate 3-D and give you better control around the pylons. Only-- \$9.95 +.95 p&h.

16K BASIC EDITOR / MINI- WORD PROCESSOR: This is a program designed to use with any printer hooked to the ATARI. The advertisement you are reading right now, was done using this BASIC EDITOR. The program is mainly used to allow anyone to enter text information into the computer and make changes using the built-in editor. This material can then be saved on cassette or DISK (designed for DISK) to be accessed later and print out in the format you will specify. The printing formats include margin width changes, and right- end justification. If you decide to specify right- end justification, the program will locate the last WORD in each line and then move it to the right, spacing itself equally until the line length (width) is equivalent to the margin width you specified earlier. For instance, this text is 106 characters long per line, the margin width equals 106. Programmed entirely in BASIC, but the execution is extremely fast, the LONGEST wait there is (with exception of DISK operations) is less than -- two (2) seconds. Requires more memory for large amounts of data. Requires 1 printer. >>ONLY-- \$15.95 +.95 p&h.



8K HARDWARE: DIRECT SOUND OUTPUT CABLE with software. You can now run the high quality sound from your ATARI sound synthesizer directly into your amplifier or home stereo system!! Just imagine playing STAR RAIDERS (tm) with true HI-FI sound!! Not the little sound that comes out of your TV speaker. You can then record this sound or further process it through your equipment. The cable plugs directly into the MONITOR jack on the side of your ATARI, therefore, it is restricted to the ATARI 800 ONLY. If you plan to use the ATARI SOUND SYNTHESIZER for true music, then you should not be without one of these cables. The demonstration software is a program that uses a joystick to control all of the sound variables graphically on the screen. This allows you to design some new sounds, and instantly be able to see what value each of the sound control variables is set at. When ordering, please specify which plug you need at the end of your cable, shown at right. Plug #1 is used for home stereo, #2 is used for an amplifier, #3 for cassette recorder, and #4 for mono-to-stereo conversion. Requires ATARI 800. ONLY-- \$17.95 +.95 p&h.



* Indicates Trademark(s) Atari, Inc.

SEBREE'S COMPUTING PRESENTS:

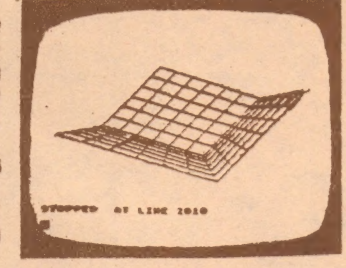
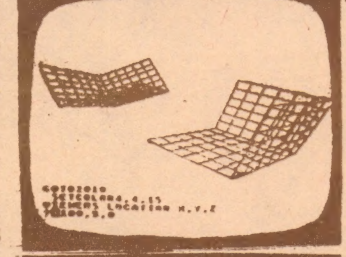
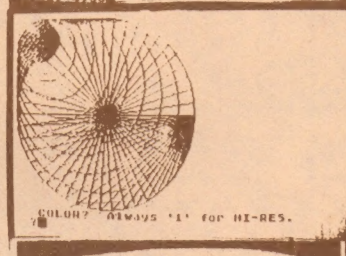
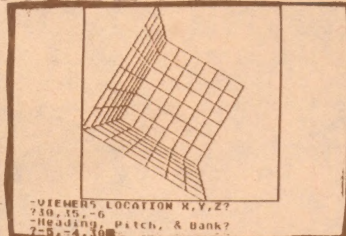
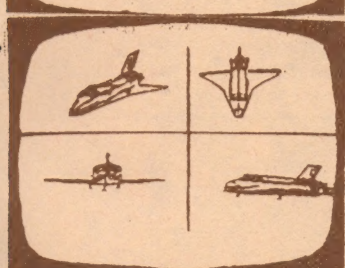
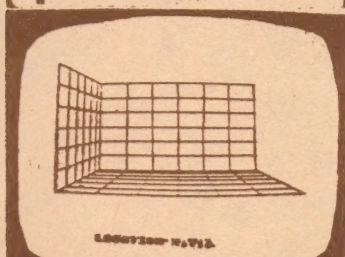
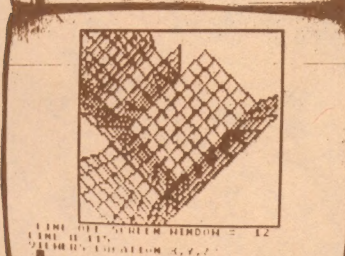
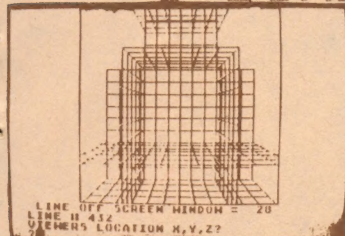
3-DIMENSIONAL COMPUTER GRAPHICS!!

FROM: SEBREE'S COMPUTING, 456 Granite Ave., Monrovia, Ca. 91016
 Phone- (213)-359-8092

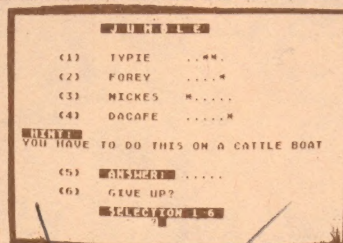
SEBREE'S COMPUTING is proud to announce a 3-Dimensional computer graphics package which will run on any ATARI PERSONAL COMPUTER SYSTEM under BASIC. There are TWELVE (12!!) programs included in this package!! ALL LISTINGS ARE GIVEN!!! This set of programs will run on an 8K machine up to a 48K machine, (last program requires 32K to run in HIRES). The base program allows you to view ANY object you so desire, from ANY location in space, even INSIDE of it!!! The software has been engineered so any person can quickly learn how to put in his own data and display it in the order that he wishes. The processing speed is very fast compared to other HIGH PRECISION 3-D algorithms. A data base with 237 XYZ points will execute in 21.5 seconds!!

The software is intended as a tutorial on the handling of exotic graphics through ATARI BASIC, therefore, anybody can use the 32 (THIRTY TWO!!) page manual to modify the software where it is shown, or leave it be so he can just control the view(s) of the objects he selects. Engineers can find the program package extremely useful in the design of solid objects. The art forms alone are extremely entertaining. The package goes through a whole chapter on controlling MULTI-COLOR graphics in HI-Resolution mode!!! Another section completely explains how to blank out the interrupts temporarily to obtain a 34% FASTER EXECUTION time!! A chapter of input examples is included, along with all the required information so that the user can do some VERY POWERFUL graphics programming. Software selectable screen resolution, multiple-color control, object erase and replacement, field of view control (telephoto or wide-angle), along with ALL of the required 3-D operations- HEADING, PITCH, & BANK (rotation), and changes of the VIEWERS LOCATION X, Y, & Z.

This package represents 6 months work under the ATARI BASIC making the floating point high precision 3D to 2D transformation generator as fast as possible, while condensed to use as little memory as possible! does anybody else sell an 8K 3-D program? Line clipping and pushing are performed! A line which intersects the screen, but the two points lie off the screen, will be 'pushed' and 'clipped' until it lies fully on the screen. Six of the 12 programs are on cassette (fills a C-30 cassette), listings and instructions are given for all the rest. All TWELVE programs plus DOS 2.08 and four (4) DIBK handling programs, totaling 17 programs on the Diskette version. This set of programs has thousands of applications!!! It may very well be the most powerful, and most often used piece of software you own!! COMPLETELY DOCUMENTED!! PRICE FOR ALL OF THIS IS ONLY: \$29.95 + \$1.50 p&h (Supplied on cassette). Diskette version- add \$5.00 for DIBK and extra costs.



16K WORD GAMES: This program includes two word games called 'GUESSIT', and 'JUMBLE'. One or Two players. In GUESSIT, you try to guess what a word the computer has chosen is. The strategy is to 'narrow' down and eliminate as many letters as you can to come as close as you can to guessing the word. Even if you don't know the word, you will eventually get it through process of elimination. But it isn't that easy, you have the option of a time limit or number of guesses limit. In JUMBLE, you must un-scramble 4 words in order to get the main answer- word 95. A hint is given on the screen as to the answer word which is made up partly of the first 4 words. An asterisk (see photo) is in the places that correspond to the letters that make-up the answer word. If you can't get the answer, a GIVE-UP option is allowed. Instructions are also included on changing the words used to guess upon within the program. Lots of fun!! Only- \$9.95 + .75 p&h.



V V V V V HARDWARE: MEMORY EXPANSION FOR THE ATARI 800 PERSONAL COMPUTER SYSTEM <<<<<

16K MEMORY CARD FOR ONLY \$129.95!
 JUST LOOK AT ALL THESE 'EXTRAS'!!

- GOLD PLATED to inhibit corrosion!!!
- ELIMINATES costly oxidation failures!!
- FASTER ACCESS TIME, 200 NS MEMORY (FASTER MEMORY)!!!
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- BACKED BY 'QUALITY HARDWARE'
- GOLD MIND- All you have to remember is to plug it in!

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TRS-80 POCKET COMPUTER SOFTWARE!!!

2K POCKET COMPUTER- WUMPUS ADVENTURE!!! Play this popular game on your POCKET COMPUTER! The WUMPUS is the mythical creature that you seek. To find him, you must visit his home territory- a maze of caverns. There are many things that can go wrong in this caverns, though: hazards abound everywhere. You are trying to locate the WUMPUS when you suddenly fall into a PIT or get snatched by a SUPER BAT colony- placing you in a random room. There are many things that can happen in this caverns. You have 3 arrows in which to shoot your prey. The arrows can travel through from 1 to 5 rooms (you specify). The cave setup is randomly different every time, relying on the built-in RANDOM NUMBER GENERATOR (remember, your POCKET COMPUTER doesn't have one!!) But if you are killed early in the game, you have the option of playing the same setup as before. The cave setup STAYS the same during the period of the current game (not just randomly changing). This way, you can predict which room the WUMPUS is in and act upon it. BEWARE the WUMPUS, he may decide to have you for lunch! Supplied on cassette with playing manual & listing. All this for only>>-- \$7.95 + .95 p&h.

ATARI 800 DISK INVENTORY SYSTEM!!

16K ATARI 800 DISK INVENTORY SYSTEM! This system on DISK allows you to keep an up-to-date inventory of your entire DISK library as it grows. The DOS used in the system is the new ATARI® DOS 2.0S system, included on the diskette. You can now check your entire inventory, search for a program to see if it is already saved, and if you have a backup copy: warning you if you don't. You can print a listing of your entire DISK library and know which DISK a particular program(s) is on. This is an extremely POWERFUL SET of programs to handle your DISK library. The program set is: 'DISKDIR', disk directory program. 'DISKINV', disk inventory program. 'DISKMENU', a good MENU program for your DISK operations. And, 'DISK01.DAT', a data file where your information is stored. Of course, the two files for DOS 2.0S included, and an 'AUTORUN' file that will automatically boot up the menu program as soon as the DOS 2.0S is loaded into memory! A MUST for anyone who has a large diskette library. ONLY- \$19.95 + .95 p&h +\$3.00 for the diskette.

TRS-80 COLOR COMPUTER SYSTEM SOFTWARE!!! AVAILABLE MAY 1981

16K COLOR COMPUTER-EXTENDED BASIC. WUMPUS ADVENTURE!! Now you can play this exciting game on your COLOR COMPUTER! This is much like the ATARI 24K version (Page ONE) with graphics and sound effects!! Read Page 1 for general info. ONLY- \$15.95 + .95 p&h.

16K COLOR COMPUTER-EXTENDED BASIC. 3-D RED BARON DOBFIGHT/ FLIGHT SIMULATOR!!! You can now play an exciting 3-D flight simulation game on your COLOR COMPUTER. See ATARI version Page 2 for general info. Requires 1 joystick, and one human pilot. ONLY- \$16.95 + .95 p&h.

16K COLOR COMPUTER-EXTENDED BASIC. DOWN THE TRENCH!! Our most popular game program comes to the COLOR COMPUTER! See ATARI version Page 1 for more information. Requires 1 joystick and one courageous pilot. Only- \$16.95 + .95 p&h.

16K COLOR COMPUTER-EXTENDED BASIC. BATTLING TANKS!! This is a 2 player version of the popular TANK war game. Similar to the ATARI version of this program, see the ATARI version, bottom of page # 1 for more information. Requires two joysticks and two human operators. Only- \$9.95 + .95 p&h.

16K COLOR COMPUTER-EXTENDED BASIC. SUBMARINE MINEFIELD navigator!! Play this popular original game on your TRS-80 COLOR COMPUTER. Very similar to the ATARI version. See ATARI version Page # 2 for more information. One OR Two players! Requires Joysticks. Only- \$9.95 + .95 p&h.

NEW Programs for BOTH ATARI & TRS-80 COLOR COMPUTERS!
Available MAY 1981,

NOTE: When ordering, specify WHICH computer you want program(s) for.

24K ATARI or 16K COLOR COMPUTER-EXTENDED BASIC. TRIP TO JUPITER SPACE ADVENTURE!! This is a new space adventure. program that goes as follows: You have to successfully launch your spacecraft from EARTH and get on a correct trajectory to JUPITER. But there are obstacles to overcome: An asteroid field shows up!! If you maneuver through the asteroid field successfully, you still have to make sure that you are on course. When you finally make it around the orbit of JUPITER, you have to be careful not to run into, or be thrown off course by one of the 13 moons!! SPECTACULAR graphics now show up as you try to bring your ship down to the planet to collect samples of the atmosphere, ground (if there is any) and the oceans. But now, you have to re-launch your craft (in high gravity) and bring it back in orbit to re-connect with your mothercraft, being careful not to destroy either ship by docking too hard!! Spectacular game!!! All this and a large playing manual for ONLY>>> \$16.95 + .95 p&h. 8/9/85

16K ATARI or COLOR COMPUTER-EXTENDED BASIC. AIR-SEA WATCH COMMANDER!! You are stationed on a missile base off the coast of Pearl Harbor. A war has broken out and you must defend the nation's best fighting equipment by using your missile-torpedoe launchers aimed at the enemy. The enemy may be in the sky or in the sea. Be sure to watch for those sneaky periscopes, otherwise you may get hit yourself from that submarine under it!!! The planes from up above can drop bombs, so be careful to use your ground to air interceptor missiles correctly. This game is much like an expanded arcade SEA-WOLF with AIR-COMMAND- like properties. Fast graphics and lots of fun!! Requires one joystick and one human commander. All for only- \$16.95 + .95 p&h.

16K ATARI or COLOR COMPUTER-EXTENDED BASIC. FLIGHT SIMULATOR!! This is a GRAPHIC flight simulator for one player! You have to successfully take-off and get to a specified altitude. If you fly too low or too high, collision may result with another aircraft!! You are to navigate a given number of miles to the next airport. Mileage varies depending on the level of difficulty you chose. During this flight, you have to be careful of the mountains coming-up in the distance. You must fly OVER these mountains thriftily, you don't want to burn up all your fuel!! After you have gone over the mountains, you must re-initialize your destination and be careful not to overshoot it. You will then see your destination airport, call in to the conning tower and ask for clearance. If you still have enough fuel (snicker) you shall attempt to land safely. If you are out of fuel, you have to try to land 'DEAD STICK'!! Great graphics!! Requires 1 joystick and one good pilot. All for only- \$17.95 + .95 p&h.
