

NIBBLE PLANETARIUM



It's easy to learn the stars with this Applesoft Hi-Res program. You can view the sky from any point in the Northern Hemisphere. In addition, you can point to any star and the program will return its name.



by Nelson R. Capes, Criterion Systems, 586 Kent Lane, Shoreview, MN 55112

I am an amateur astronomer, which means that I spend a lot of time looking through a telescope. I've spent countless summer and winter nights gazing at the sky and learning to find my way around. The road signs of the night sky are the constellations. It doesn't take long to learn that the two stars in the Big Dipper's bowl point at the North Star, and the three stars in the Dipper's handle point to Arcturus, a very bright (first magnitude) star. The next step is to learn the names of the other highly visible stars and their locations.

In most major cities you can go to a planetarium to see the stars projected on a giant dome overhead. A planetarium's mechanisms are extremely complex and expensive, and are able to do things like move the point of observation to anywhere on the Earth's surface, move backward and forward in time, and pick out the various stars. Now, with Nibble Planetarium, a teaching and learning aid for the beginning astronomer, most of these functions can be accomplished using the Apple's display.

USING THE PROGRAM

To start the program, type RUN PLANETARIUM. After the initial display, the program loads its star table and asks whether you want to restore an old setup. If you answer Y, it asks for a file name and you can load in a set of time and coordinate data from a previous run. This lets you develop a star atlas. (See the description of the save and load options in the CHANGING PARAMETERS section.) If you answer N, then the computer asks you for information to create a star chart for your specific location and date.

Let's run through a sample session. First, you must supply the longitude. The program asks:

LONGITUDE (DEG = -180 TO 180):

Enter your longitude in degrees, and press <RETURN>. Then enter the number of minutes in the same way.

At the prompt:

LATITUDE (0 TO 90):

Enter your latitude in degrees and press <RETURN>. The program will work only for the Northern Hemisphere, so negative values are not allowed.

The next query is:

DATE (MONTH = 1 TO 12):

Enter the month and press <RETURN>. Then enter the day of the month, and press <RETURN>.

Next, you enter the time:

TIME (HR = 0 TO 23):

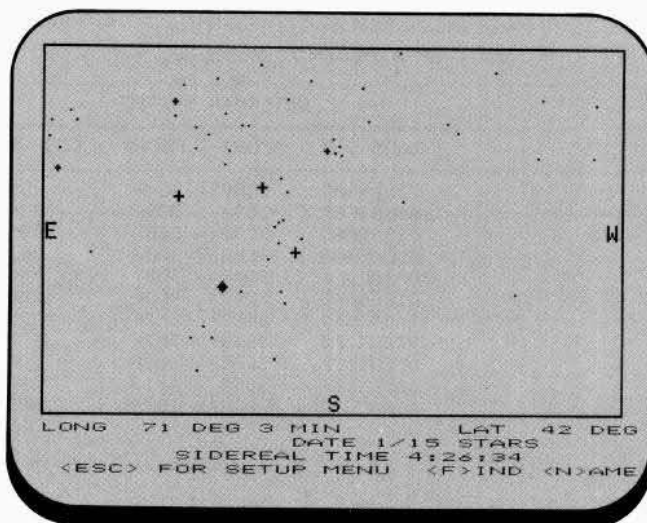
Enter the standard time (if you are on daylight savings time, you must first convert to standard time). Use the 24-hour time system, where midnight is 0 hours and you add 12 hours to all P.M. times. After you enter the hour, enter the minutes.

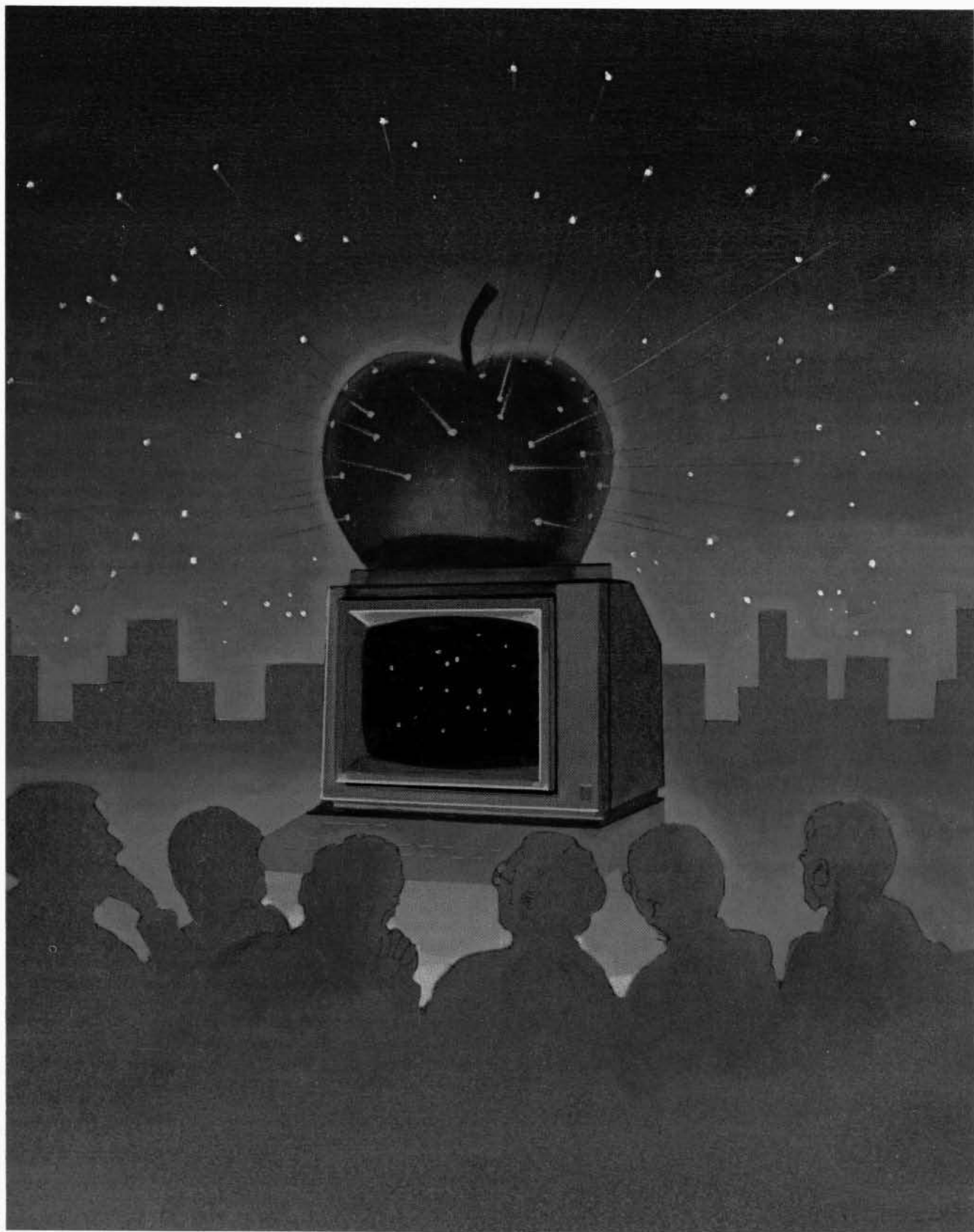
Finally, indicate the horizon you want to view:

HORIZON (N = NORTH, S = SOUTH):

The program can display the stars above either the northern or the

FIGURE 1: Sky Toward Southern Horizon From Boston on January 15. Constellations Orion, Taurus, Gemini and Part of Leo Are Shown.





southern horizon. Enter your choice by pressing N or S.

When you have input all this information, the screen clears, and a Hi-Res picture of the sky for the date, time, and place you selected is drawn (Figure 1). The night sky is surrounded by a border line. At the top of the screen is the overhead point, called the zenith. The bottom of the screen is the horizon. The right and left sides of the screen are east and west, depending on the horizon you selected. All stars up to magnitude three are shown in their true relative positions. In addition, a few higher magnitude stars are shown to make certain constellations more recognizable. Four different symbols (a diamond, a large plus sign, a small plus sign, and a dot) are used to represent different magnitude ranges.

At the bottom of the Hi-Res screen are three lines that tell you the date, location (longitude and latitude) and sidereal time. The bottom line tells you the valid commands. The sidereal time clock starts and runs as long as you don't enter any new parameters. Every half hour, the screen is cleared and the positions of the stars are updated, so they appear to move across the sky from east to west, just as they do in the real sky. (You can disable the screen clearing by selecting continuous display mode from the setup menu.) If you selected the northern horizon, you will see that the stars don't move in paths from east to west. Instead, they appear to circle around a point in the middle of the screen. This is the North Celestial Pole, which is very close to the star Polaris.

The three available commands are Find, Name, and <ESC>ape. Find and Name are described later, and <ESC> takes you to the setup menu. If you press <ESC> accidentally, you can restore the star display without a delay for recalculation if you press <ESC> again before you make any selection from the menu.

CHANGING PARAMETERS

Now we come to the real power of the Nibble Planetarium. Suppose you are currently viewing the sky from Cleveland and would like to see what the night sky looks like from Boston at the same time. No problem! To change your latitude and longitude, just press <ESC> and select item 2 from the menu (Figure 2). The computer responds by asking for the latitude. Enter the latitude for Boston:

42<RETURN>

Now select item 1 from the menu, and the computer responds by asking for the longitude. Enter the degrees:

71<RETURN>

FIGURE 2: Setup Menu

```

      SETUP MENU
--> 1. LONGITUDE: 71 DEG 3 MIN
    2. LATITUDE: 42 DEG
    3. DATE: 1/15
    4. SID. TIME: 4:47
    5. HORIZON: S
    6. PLOT MODE: INDIVIDUAL
    7. SAVE PARAMETERS TO DISK
    8. LOAD PARAMETERS FROM DISK
    9. QUIT
USE ARROWS OR SELECT NUMBER: 1?
<ESC> TO RETURN TO STAR SCREEN

```

Then enter the minutes:

3<RETURN>

Although the two cities are in the same time zone, they are at different longitudes, so their *sidereal times* differ even though their standard times are the same. Therefore, the program requires you to re-enter the time whenever you change the longitude. Enter the desired time in response to the prompts. *Note:* Because the time display is in sidereal time, the setup menu also displays the last standard time you input. Use this value when calculating offsets. For instance, the menu might show that the sidereal time is 06:30, and that you last entered 22:15. To get the sky an hour later, you would change the time to 23:15, not 07:30. Now all the parameters are correct. Just press <ESC> to display the Boston sky!

The first six items of the setup menu are pretty self explanatory. But what about save and load (items 7 and 8)? These commands let you develop a library of sky snapshots. For example, you might want to save pictures of the sky at your location for the first of every month at a given time of night. That way, you'll know what the constellations will look like at regular intervals during the year. Note that this option does not actually save the screen; it only saves the parameters currently selected.

The save and load options are easy to use. You will be asked for the file name. If you press <RETURN>, the disk directory is displayed and the FILE.NAME prompt repeated.

IDENTIFYING STARS

Now you know how to set up the time and place and move to another location. What about identifying stars at your location? As your interest in astronomy develops, it is very satisfying to be able to look at the sky and pick out stars by name. Nibble Planetarium helps you do this too. Suppose you see a star on the screen and would like to know its name. Just type N. The program draws a small square in the center of the screen. Using the I, J, K, and M keys (and <REPT> on the II Plus), move the square up, left, right, and down until it includes the star you want to identify. Press <RETURN>. If the star's name is in the star table, the computer will display it. If more than one star is included in the square, the first one in the star list will be displayed. It should be possible to position the square so that it includes only the star you want to identify.

Now suppose you already know a star's name, but would like to know where it is in the sky. Just type F. The program will ask for the star's name. Enter the star's name and press <RETURN>. If the star is in the table, a square will flash around the star on the screen for about ten seconds. If the star would not be visible in the sky at your current location and time, the program tells you. To exit from this mode, press <RETURN> without entering a star name. The sidereal clock will restart.

Since the star table is created by the program shown in Listing 1, you may check the DATA statements in that program for the correct spelling of the stars for which data is available.

Most of the brighter stars have ancient Arabic, Greek, or Roman names. In some cases, more than one ancient name is used. In more modern times, more systematic approaches have been taken to star names. One system uses Greek letters to represent the stars in ascending magnitude for each constellation. Under this system, Sirius is called Alpha Canis Major. A more recent system numbers the stars in increasing right ascension for a given constellation. Most of the star names in this program are the ancient ones.

ENTERING AND SAVING THE PROGRAM

To key in the complete Nibble Planetarium system you must enter Listings 1, 2, and 3. Listing 1 is an Applesoft program that creates a text file containing the star names and coordinates. Enter the program as shown and save it with the command:

SAVE TABLE.CREATE

When you run TABLE.CREATE it creates the text file STAR.TABLE. To make changes in STAR.TABLE you can either change the DATA statements in TABLE.CREATE and run it again, creating a new STAR.TABLE, or you can edit STAR.TABLE with a compatible word processor, such as Apple Writer. Some typing errors will be caught when you run the program. The message "ERROR READING DATA. LAST STAR READ SUCCESSFULLY WAS..." is displayed. Find the star named in Listing 1, and look for a typing error in the next line.

Enter the main Applesoft program (Listing 2) and save it with the command:

SAVE PLANETARIUM

This program relocates itself above the Hi-Res screen, so it is important that you save it before you try to run it.

Listing 3 is the shape table that contains the four different star images, the square cursor, and the letters N, E, S, and W. Enter the Monitor by typing CALL -151 <RETURN> and type the code as shown. Save the table with the command:

BSAVE STAR.SHAPES,A\$300,L\$7A

For help in entering Nibble listings, see "A Welcome to New Nibble Readers" at the beginning of this issue.

HOW THE PROGRAM WORKS

To understand the theory of program operation, you must be familiar with the concepts of sidereal time, right ascension, and declination. Sidereal time is the system of measuring time with respect to the stars. Due to the earth's rotation, a sidereal day is about four minutes longer than a solar day, so sidereal time is considerably different even from Greenwich standard time. If you imagine that the stars are pasted on the inside of a huge celestial sphere,

Enter the star's name, and a square will flash around the star on the screen for about ten seconds.

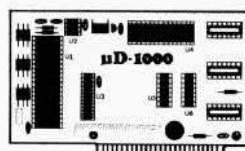
with a north and south pole, right ascension (R.A.) is the equivalent of longitude, measuring a star's radial position. Declination (DEC) is the equivalent of latitude, measuring its position from the celestial equator toward one of the celestial poles. A star's position is usually expressed in hours and minutes of R.A. and degrees of declination.

The program produces a high resolution graphics picture of the night sky that shows the stars very close to their true relative positions. Of course, any attempt to project a spherical surface, such as the sky, onto a plane will result in some distortion. The distortion is minimized by restricting the view to either the northern or southern horizon and calculating the star positions for each set of parameters. By the way, major failings of other programs I've seen are that they do not calculate star positions for a particular time, nor do they restrict the view; instead, they attempt to show the entire sky for the summer or winter. These programs do not present a true view of the night sky and can often confuse the amateur stargazer.

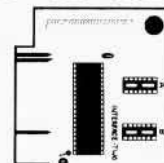
There are separate algorithms for the northern and southern horizons (see Listing 2). If the southern horizon is selected, a check is made for circumpolar stars (not displayed) and stars with declinations (DEC) less than the negative of the latitude (lines 780-820), which are never visible. Then, after the right ascension is converted from hours to radians in line 840, line 850 determines if the star has risen. The University of Minnesota Astronomy Department was kind enough to provide me with the algorithm to calculate this. Given the variables:

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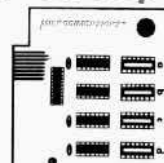
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Z = zenith angle in degrees
S = sidereal time in hours
D = declination in degrees
R = right ascension in hours
L = latitude in degrees

then a star is visible if:

$$\cos L \cos D \cos H = > -\sin L \sin D$$

Having found the visible stars, I now scale the plot so that the meridian is in the center of the screen with six hours of R.A. on either side (line 880). Finally, the star's declination is scaled so that the celestial equator divides the screen with 45 degrees of declination above and below the equator (line 890).

The situation is a little more complex for the northern horizon. Here, I used a polar coordinate plot so that the stars would appear to circle around Polaris. Again, preliminary checking is done in line 940 for visibility (using the same zenith angle algorithm). Then, in lines 950-1040, the R.A. and DEC are used to plot the stars' positions in a polar coordinate plot with Polaris at the center. My algorithm was derived from an article by Mark Dahmke that appeared in the April 1979 issue of Byte. Basically, the star's R.A. is converted to radians and rotated 90 degrees (6 hours) counter-clockwise in line 970. The result is scaled appropriately, and the X,Y coordinates are calculated:

$$X = R1 \cos (XP)$$

$$Y = R1 \sin (XP)$$

where R1 is the scale factor and XP is the converted hour angle.

ADDING STARS TO THE LIST

Stars may be easily added to the list. The first step is to insert a DATA line in Listing 1. Enter the DATA line using the following format for the data:

R.A., Declination, Magnitude, Star Name

Use the R.A. value to properly position the entry in the list. If the R.A. value you have is given in hours and minutes, convert the minutes to a two-place decimal. Similarly, the declination should be converted to a one-place decimal.

For example, the star Aldib (Delta Drago) is shown in the star charts with R.A. of 19 hr., 13 min.; DEC of 67 deg., 37 min.; and magnitude of 3.2. With the minutes converted, you would enter the data line as follows:

```
1685 DATA 19.22, 67.6, 3.2, ALDIB
```

The second step is to change the value of NS in line 120 of Listing 1 and re-run the program to generate a new table file. Finally, make sure that the dimensions of the arrays in line 130 of Listing 2 are high enough to accommodate this new value. All of the values in line 130 of Listing 2 should be changed to the same value, if a change is necessary.

ADJUSTING THE TIME

The variable W controls the speed of the clock. Increase its value in line 90 of Listing 2 to slow the clock, and decrease it to accelerate the clock.

continued on page 46

Nibble Planetarium, Investor Price File Editor, Text File Utility and Recovering Deleted ProDOS Files are available on diskette for an introductory price of \$17.95 plus \$1.50 shipping/handling (\$2.50 outside the U.S.) from Nibble, 45 Winthrop St., Concord, MA 01742. Introductory price expires 12/31/85.

LISTING 1: TABLE.CREATE

```

10 REM *****
20 REM * TABLE.CREATE *
30 REM * BY NELSON R. CAPES *
40 REM * COPYRIGHT (C) 1985 *
50 REM * BY MICROSPARC, INC *
60 REM * CONCORD, MA. 01742 *
70 REM *****
80 HOME : VTAB 12: PRINT "CREATING STAR.TABL
E"
90 DS = CHRS (4)
100 PRINT DS"OPEN STAR.TABLE": PRINT DS"CLOS
E"
110 PRINT DS"DELETE STAR.TABLE"
120 NS = 166: REM TO ADD STARS, CHANGE NS HER
E AND ALL DIM VALUES IN LINE 130 OF PLAN
ETARIUM
130 ONERR GOTO 1870
140 DIM RA(NS),DEC(NS),MAG(NS),NM$(NS)
150 FOR I = 1 TO NS: READ RA(I),DEC(I),MAG(I
),NM$(I): NEXT : POKE 216,0
160 PRINT DS"OPEN STAR.TABLE": PRINT DS"WRIT
E STAR.TABLE"
170 PRINT NS: FOR I = 1 TO NS: PRINT RA(I),D
EC(I),MAG(I),NM$(I): NEXT
180 PRINT DS"CLOSE STAR.TABLE"
190 HOME : VTAB 12: PRINT "DONE": END
200 DATA .12,28.9,2.1,ALPHERATZ
210 DATA .12,58.8,2.4,CAPH
220 DATA .2,15.2,9,ALGENIB
230 DATA .42,-42.5,2.4,ANKAA
240 DATA .65,56.4,2.3,SCHEDAR
250 DATA .7,-18.2,2.2,DIPDA
260 DATA .91,60.6,2.3,GAMMA CASSIOPEIA
270 DATA 1.13,35.5,2.4,MIRACH
280 DATA 1.4,60.1,2.8,RUCKBAH
290 DATA 1.62,-57.4,.6,ACHERNAR
300 DATA 1.87,63.5,3.5,SEGIN
310 DATA 1.88,20.7,2.7,SHERATAN
320 DATA 2.03,42.2,2.2,ALAMAK
330 DATA 2.04,89.1,2.1,POLARIS
340 DATA 2.08,23.3,2.2,HAMAL
350 DATA 3.02,4.2,8,MENKAR
360 DATA 3.1,40.8,2.8,ALGOL
370 DATA 3.37,49.8,1.9,MIRFAK
380 DATA 3.75,24.3,ALCYONE
390 DATA 3.87,31.8,2.9,MENKHIB
400 DATA 4.28,15.5,4,GAMMA TAURUS
410 DATA 4.33,17.4,5,DELTA TAURUS
420 DATA 4.43,15.8,4,THETA TAURUS
430 DATA 4.45,19.1,3.6,AIN
440 DATA 4.57,16.4,1.1,ALDEBARAN
450 DATA 4.92,33.1,2.9,HASSALEH
460 DATA 5.07,41.2,3.3,HOEDUS
470 DATA 5.1,-5.1,2.9,CURSA
480 DATA 5.22,-8.2,.3,RIGEL
490 DATA 5.23,46.2,CAPELLA
500 DATA 5.4,6.3,1.7,BELLATRIX
510 DATA 5.45,-20.8,3,NIHAL
520 DATA 5.4,28.6,1.8,ELNATH
530 DATA 5.5,-3.2,5,MINTAKA
540 DATA 5.51,-17.9,2.7,ARNEB
550 DATA 5.54,9.9,3.7,HEKA
560 DATA 5.57,-5.9,2.9,HATSYA
570 DATA 5.58,-1.2,1.7,ANILAM
580 DATA 5.65,-34.1,2.7,PHACT
590 DATA 5.65,-2.2,ALNITAK
600 DATA 5.77,-9.7,2.2,SAIPH
610 DATA 5.9,7.4,0,BETELGEUSE
620 DATA 5.95,45.2,1,MENKALINAN
630 DATA 5.96,37.2,2.7,THETA AURIGA
640 DATA 6.22,22.5,3.4,TEJAT PRIOR
650 DATA 6.35,22.5,3.2,TEJAT POSTERIOR
660 DATA 6.35,-17.9,2,MIRZAM
670 DATA 6.38,-52.7,-.9,CANOPUS
680 DATA 6.6,16.4,1.9,ALHENA
690 DATA 6.7,13.0,4,XI GEMINI
700 DATA 6.7,25.2,3.2,MEBSUTA
710 DATA 6.73,-16.7,-1.6,SIRIUS
720 DATA 6.82,-50.6,2.8,TAU PUPPIS
730 DATA 6.85,33.9,4,THETA GEMINI
740 DATA 6.95,-28.9,1.6,ADARA
750 DATA 7.03,20.6,4,MEKBUDA
760 DATA 7.12,-26.4,2,WEZEN

```

```

770 DATA 7.27,16.8,4,LAMBDA GEMINI
780 DATA 7.26,-37.1,2.7,PI PUPPIS
790 DATA 7.3,22.0,3.5,WASAT
800 DATA 7.38,-29.3,2.4,ALUDRA
810 DATA 7.55,32.1,6,CASTOR
820 DATA 7.63,5.3,.5,PROCYON
830 DATA 7.7,24.6,4,KAPPA GEMINI
840 DATA 7.72,28.1,1.2,POLLUX
850 DATA 8.05,-39.9,2.3,ZETA PUPPIS
860 DATA 8.15,-47.3,1.9,GAMMA VELA
870 DATA 8.37,-59.4,1.7,AVIOR
880 DATA 8.73,-54.6,2,DELTA VELA
890 DATA 9.12,-43.3,2.2,SUHAIL
900 DATA 9.27,-59.2,2.2,IOTA CARINA
910 DATA 9.35,-54.9,2.6,KAPPA VELA
920 DATA 9.43,-8.5,2.2,ALPHARD
930 DATA 9.73,23.9,3.1,RAS ELASED AUSTRALIS
940 DATA 9.85,26.2,4.1,RAS ELASED BOREALIS
950 DATA 10.07,16.8,4,ETA LEO
960 DATA 10.12,12.1,1.3,REGULUS
970 DATA 10.25,23.6,3.6,ADHAFAERA
980 DATA 10.3,20.2,6,ALGEIBA
990 DATA 10.75,-49.3,2.8,MU VELA
1000 DATA 11.56,5.2,4,MERAK
1010 DATA 11.03,61.9,1.9,DUBHE
1020 DATA 11.22,15.6,3.4,COXA
1030 DATA 11.22,20.7,2.6,ZOSMA
1040 DATA 11.8,14.7,2.2,DENEbola
1050 DATA 11.87,53.9,2.5,PHEDA
1060 DATA 12.22,57.3,3.3,MEGREZ
1070 DATA 12.23,-17.4,2.8,GIENA
1080 DATA 12.48,-57.1,6,GACRUX
1090 DATA 12.6,-23.2,2.8,KRAZ
1100 DATA 12.67,-1.3,2.9,ARICH
1110 DATA 12.67,-48.8,2.4,MUHLIFAIN
1120 DATA 12.76,-59.5,1.5,MIMOSA
1130 DATA 12.88,56.1,1.7,ALIOth
1140 DATA 12.92,38.5,2.9,COR CAROLI
1150 DATA 13.02,11.1,2.9,VINDEMIATRIX
1160 DATA 13.38,55.1,2.4,MIZAR
1170 DATA 13.39,-11.1,2,SPICA
1180 DATA 13.63,-53.3,2.6,EPSILON CENTAURUS
1190 DATA 13.76,49.5,1.9,ALKAID
1200 DATA 13.88,18.5,2.8,ETA BOOTES
1210 DATA 14.08,-36.2,2.3,MENKENT
1220 DATA 14.23,19.3,.2,ARCTURUS
1230 DATA 14.52,38.4,3,HARIS
1240 DATA 14.57,-42.2,6,ETA CENTAURUS
1250 DATA 14.74,27.2,2.7,IZAR
1260 DATA 14.82,-15.9,2.8,ZUBEN-ELGENUBI
1270 DATA 14.85,74.3,2.2,KOCHAB
1280 DATA 14.95,-43.2,8,BETA LUPUS
1290 DATA 15.25,-9.3,2.7,ZUBEN-ESCHAMALI
1300 DATA 15.35,72.0,3.1,PKERKAD
1310 DATA 15.55,26.8,2.3,ALPHECCA
1320 DATA 15.72,6.5,2.7,UNUK
1330 DATA 15.75,77.7,6,XI URSA MINOR
1340 DATA 15.93,-25.9,4,PI SCORPIO
1350 DATA 15.98,-22.5,2.5,DSCHUBBA
1360 DATA 16.07,-19.7,2.6,ACRAB
1370 DATA 16.22,-3.6,3,YED PRIOR
1380 DATA 16.28,-25.3,4,SIGMA SCORPIO
1390 DATA 16.28,75.8,6,ETA URSA MINOR
1400 DATA 16.47,-26.4,1.2,ANTARES
1410 DATA 16.48,21.6,2.8,KORNEPHOROS
1420 DATA 16.55,-28.4,TAU SCORPIO
1430 DATA 16.6,-10.5,1.9,ZETA OPHIUCUS
1440 DATA 16.78,-38.4,MU SCORPIO
1450 DATA 16.8,-34.2,2.4,EPSILON SCORPIUS
1460 DATA 16.83,81.9,5,EPSILON URSA MINOR
1470 DATA 17.12,-43.1,5,ETA SCORPIO
1480 DATA 17.15,-15.7,2.6,SABIK
1490 DATA 17.38,-55.5,2.8,BETA ARA
1500 DATA 17.48,52.3,3,ALWAD
1510 DATA 17.48,-37.3,2.8,UPSILON SCORPIUS
1520 DATA 17.53,-37.1,1.7,SHAULA
1530 DATA 17.57,12.6,2.1,RASALHAGUE
1540 DATA 17.58,-43.2,THETA SCORPIUS
1550 DATA 17.67,-39.2,5,KAPPA SCORPIUS
1560 DATA 17.7,4.6,2.9,KELB ALRAI
1570 DATA 17.7,-39.9,4,IOTA SCORPIO
1580 DATA 17.72,86.6,4.4,PKERKARD
1590 DATA 17.93,51.5,2.4,ELTANIN
1600 DATA 18.07,-30.4,3.1,NUSHABA
1610 DATA 18.32,-29.9,2.8,KAUS MEDIUS
1620 DATA 18.37,-34.4,1.9,KAUS AUSTRALIS

```

continued on page 49

LISTING 1: TABLE.CREATE (continued)

```

1630 DATA 18.43,-25.4,2.8,KAUS BOREALIS
1640 DATA 18.6,38.8,1,VEGA
1650 DATA 18.73,-27.4,PHI SAGITTARIUS
1660 DATA 18.88,-26.3,2.1,NUNKI
1670 DATA 19.02,-29.9,2.7,ASCELLA
1680 DATA 19.05,-27.6,4,TAU SAGITTARIUS
1690 DATA 19.5,27.9,3.2,ALBIREOR
1700 DATA 19.75,10.5,2.8,TARAZED
1710 DATA 19.8,45.3,SADOR
1720 DATA 19.82,8.8,9,ALTAIR
1730 DATA 20.35,40.2,2.3,SADR
1740 DATA 20.38,-56.8,2.1,PEACOCK
1750 DATA 20.67,45.2,1.3,DENEb
1760 DATA 20.75,33.9,2.6,GIENAH
1770 DATA 21.3,62.5,2.6,ALDERAMIN
1780 DATA 21.72,9.7,2.5,ENIF
1790 DATA 21.75,-16.3,3,DENEb ALGEDI
1800 DATA 22.05,-0.9,2.9,SADALMELIK
1810 DATA 22.1,-47.1,2.2,ALNAIR
1820 DATA 22.68,-47.2,2,BETA GRUS
1830 DATA 22.93,-29.8,1.3,FOMALHAUT
1840 DATA 23.03,27.9,2.6,SHEAT
1850 DATA 23.05,15.2,6,MARKAB
1860 REM ERROR TRAP
1870 PRINT "ERROR READING DATA.": PRINT "LAST
STAR READ SUCCESSFULLY WAS ";NM$(I-1)
); END

```

END OF LISTING 1

KEY PERFECT RUN ON TABLE.CREATE		
CODE-5.0	LINE# - LINE#	CODE-4.0
C0FFF1FF	10 - 100	708C
ED42C93D	110 - 200	A433
4C144406	210 - 300	6F6D
216A6E9F	310 - 400	729F
9CA212F5	410 - 500	783D
C13209A9	510 - 600	6ADB
367927EB	610 - 700	83F9
261141E1	710 - 800	79A0
B83110DC	810 - 900	7A78
F5107D13	910 - 1000	8512
F8C3FC2A	1010 - 1100	72EF
5416BFFF	1110 - 1200	849F
B569F896	1210 - 1300	87AD
08774395	1310 - 1400	8AAE
A1ADFC9	1410 - 1500	875F
CB11667A	1510 - 1600	8B24
94BAAAB5	1610 - 1700	8635
CDE09CDE	1710 - 1800	6EBC
9312E4B6	1810 - 1870	5C7C
69A6A511	= PROGRAM TOTAL =	
		13F6

LISTING 2: PLANETARIUM

(For ProDOS, change CATALOG in lines 2160 and 2260 to CAT)

```

10 REM *****
20 REM " PLANETARIUM "
30 REM " BY NELSON R. CAPES "
40 REM " COPYRIGHT (C) 1985 "
50 REM " BY MICROSPARC, INC. "
60 REM " CONCORD, MA. 01742 "
70 REM *****
80 TEXT : HOME : VTAB 9: HTAB 5: INVERSE : PRINT
"*** NIBBLE PLANETARIUM ***": NORMAL :
IF PEEK (104) < > 64 THEN POKE 103,1
: POKE 104,64: POKE 16384,0: PRINT CHR$(
4)"RUN PLANETARIUM"
90 DS = CHR$(4):GS = CHR$(7):HCOLOR= 3: SCALE=
1: ROT= 0:W = 265: REM W IS TIME DELAY V
ALUE
100 DIM MD$(1),XS(1):MD$(0) = "INDIVIDUAL":M
D$(1) = "CONTINUOUS":XS(0) = " " :XS(1)
= "-->":PFLAG = 0
110 DIM DD(12): FOR I = 1 TO 12: READ DD(I):
NEXT
120 DATA 31,28,31,30,31,30,31,31,30,31,30,3
1
130 DIM RA(170),DEC(170),MAG(170),NAME$(170)
,MG(170),XC%(170),YC%(170)

```

```

140 HOME : VTAB 9: HTAB 5: INVERSE : PRINT "
*** NIBBLE PLANETARIUM ***": NORMAL : PRINT
: HTAB 11: PRINT "BY NELSON R. CAPES": PRINT
: HTAB 2: PRINT "COPYRIGHT (C) 1985 BY M
ICROSPARC INC"
150 GOSUB 2760
160 GOSUB 1050: REM INITIALIZE ARRAYS
170 HOME
180 PRINT "BE SURE CAPS ARE LOCKED ON.": PRINT
190 INPUT "DO YOU WANT TO RESTORE AN OLD SET
UP? ";AS$
200 IF AS$ = "N" THEN TF = 1: GOTO 270
210 IF AS$ < > "Y" THEN PRINT GS: VTAB: PEEK
(37): CALL - 868: GOTO 190
220 EF = 1: ONERR GOTO 2350
230 VTAB 3: CALL - 868: PRINT "FILE NAME (<
RETURN> FOR CATALOG)"; INPUT "":AS:N$ =
1
240 IF LEN (AS$) > 0 THEN FOR NC = 1 TO LEN
(AS$):NA = ASC ( MID$( AS$,NC,1)):NF = ((
NA > 64 AND NA < 91) OR (NA = 46) OR (NA
> 47 AND NA < 58)) AND NF = 1: NEXT : IF
LEN (AS$) > 13 OR NF = 0 THEN VTAB 3: CALL
- 868: PRINT GS"INVALID NAME": FOR NC =
1 TO 1000: NEXT : GOTO 230
250 IF AS$ = "" THEN HOME : PRINT DS"CATALOG
": PRINT : INPUT "PRESS <RETURN> TO CONT
INUE ... ";BS$: HOME : GOTO 230
260 GOSUB 2270: GOTO 290
270 S1 = 1:S2 = 1:S3 = 1:S4 = 1:S5 = 0:S6 = 1
:S7 = 0:S8 = 0:S9 = 0
280 PRINT : GOSUB 1140: REM GET PARAMETERS
290 S1 = 0:S2 = 0:S3 = 0:S4 = 0:S5 = 0:S6 = 0
:S7 = 0:S8 = 0:S9 = 0
300 FOR I = 1 TO NS:MG(I) = MAG(I): NEXT
310 HOME : VTAB 22: PRINT "CALCULATING AND P
LOTTING STARS": HGR
320 IF HZ$ = "S" THEN DRAW 7 AT 2,83: DRAW
8 AT 272,83: DRAW 9 AT 138,157: GOTO 340
330 DRAW 6 AT 138,157: DRAW 7 AT 272,83: DRAW
8 AT 2,83
340 HPLOT 0,0 TO 279,0 TO 279,159 TO 0,159 TO
0,0
350 POKE - 16368,0: FOR I = 1 TO NS
360 IF PEEK ( - 16384) = 155 THEN I = NS: NEXT
:CF = 1: GOTO 2470
370 XP = RA(I):YP = DEC(I)
380 IF HZ$ = "S" THEN 410: REM S. HORIZON
390 RC = 0: GOSUB 910: REM N. HORIZON
400 GOTO 430
410 REM
420 RC = 0: GOSUB 780
430 IF RC = 1 THEN 510
440 YC%(I) = INT (YP):XC%(I) = INT (XP)
450 IF XP < 2 OR YP < 2 OR XP > 277 OR YP >
157 THEN 510
460 IF MAG(I) > 1.5 THEN DRAW 4 AT XP,YP: GOTO
500
470 IF MAG(I) > .5 AND MAG(I) < = 1.5 THEN
DRAW 3 AT XP,YP: GOTO 500
480 IF MAG(I) > - .5 AND MAG(I) < = .5 THEN
DRAW 2 AT XP,YP: GOTO 500
490 DRAW 1 AT XP,YP
500 MG(I) = 99
510 NEXT
520 VTAB 21: HTAB 1: PRINT "LONG ";LNH" DEG
";LGM;" MIN LAT ";LT;" DEG": VTAB
24: PRINT " <ESC> FOR SETUP MENU <F>IND
<N>AME";
530 VTAB 22: HTAB 1: PRINT TAB( 16):"DATE "
;MN:"/" :DAY
540 GOSUB 700
550 KEY = PEEK ( - 16384): IF KEY < 128 THEN
640
560 POKE - 16368,0
570 IF KEY = 155 THEN TEXT : HOME : GOTO 24
60
580 IF KEY = 198 THEN S5 = 1: GOSUB 1140: GOTO
650: REM FIND STAR WITH CURSOR
590 IF KEY = 206 THEN S7 = 1: GOTO 640: REM
NAME STAR INDICATED BY CURSOR
600 CALL - 1052: GOTO 640
610 REM QUIT
620 GOSUB 2750: INPUT "ARE YOU SURE YOU WANT
TO QUIT? ";AS$: IF AS$ = "Y" THEN TEXT :
HOME : END

```

continued on next page

LISTING 2: PLANETARIUM (continued)

```

630 VTAB 23: CALL - 868: GOTO 310
640 GOSUB 1140: REM GET PARAMETERS
650 IF S1 = 1 OR S2 = 1 OR S3 = 1 OR S4 = 1 OR
S6 = 1 OR S9 = 1 THEN S1 = 0: S2 = 0: S3 =
0: S4 = 0: S5 = 0: S6 = 0: S9 = 0: GOTO 300:
REM NEW SETUP
660 IF S7 = 1 THEN S7 = 0: GOTO 680: REM C
ONTINUE IF IDENTIFYING STAR
670 IF S5 = 1 THEN S5 = 0: GOTO 680: REM JU
ST CONTINUE IF DISPLAYING STAR
680 T = T + 1: IF T > 1800 THEN T = 0: ON PFL
AG + 1 GOTO 310,350: REM HALF-HOUR UP
690 GOTO 520
700 REM TIME DELAY ROUTINE
710 FOR Z = 1 TO W: NEXT Z
720 SEC = SEC + 1: IF SEC = 60 THEN MIN = MIN
+ 1: SEC = 0
730 IF MIN = 60 THEN HR = HR + 1: MIN = 0
740 IF HR = 24 THEN HR = 0
750 LST = HR + (MIN / 60) + (SEC / 1800)
760 VTAB 23: PRINT TAB( 9): "SIDEREAL TIME "
:HR: LEFT$ ("":0",1 + (MIN < 10))MIN: LEFT$
("":0",1 + (SEC < 10))SEC
770 RETURN
780 REM CIRCUMPOLARS IN N. SKY
790 IF YP > LT THEN RC = 1: RETURN
800 IF YP < LT - 90 THEN RC = 1: RETURN
810 REM SOUTHERN CUTOFF
820 LET L = LT * 3.14 / 180: LET D = YP * 3.
14 / 180
830 REM CONVERT LAT AND DEC TO RADIANS
840 LET H = 3.14 * (LST - XP) / 12: REM HOU
R ANGLE IN RADIANS
850 IF COS (L) * COS (D) * COS (H) < - SIN
(L) * SIN (D) THEN RC = 1: RETURN
860 XP = LST - XP: IF XP < - 12 THEN XP = XP
+ 24
870 IF XP > 12 THEN XP = XP - 24
880 XP = 140 + XP * 23.33: IF XP > 279 OR XP <
0 THEN RC = 1: RETURN: REM ALLOWS 12 H
R OF RA
890 YP = 1.78 * (LT - YP): IF YP < 0 OR YP >
159 THEN RC = 1: RETURN: REM ALLOW 90
DEG OF DEC
900 RETURN
910 IF YP < 0 THEN RC = 1: RETURN: REM STA
RS SOUTH OF EQUATOR IN SOUTHERN HORIZON
920 LET L = LT * 3.14 / 180: LET D = YP * 3.
14 / 180
930 LET H = 3.14 * (LST - XP) / 12: REM HOU
R ANGLE IN RADIANS
940 IF COS (L) * COS (D) * COS (H) < - SIN
(L) * SIN (D) THEN RC = 1: RETURN
950 XP = XP - LST
960 YP = YP * 3.1416 / 180: REM CONVERT DEC
TO RADIANS
970 XP = (XP * 15 * 3.1416 / 180) - 1.5708: REM
CONVERT RA TO RADIANS AND ROTATE 90 DEG
COUNTERCLOCKWISE
980 F = 140 / 1.5708: REM MAP SCALE FACTOR
990 R1 = F * (1.5708 - ABS (YP))
1000 X = R1 * COS (XP) + 140
1010 Y = R1 * SIN (XP) + 160 - (1.78 * LT)
1020 XP = X: YP = Y
1030 IF XP > 279 OR XP < 0 OR YP > 159 OR YP
< 0 THEN RC = 1
1040 RETURN
1050 REM INITIALIZE ARRAYS
1060 HOME: VTAB 11: HTAB 13: INVERSE: PRINT
"LOADING TABLES": NORMAL
1070 EF = 2: ONERR GOTO 2350
1080 PRINT D$ "BLOAD STAR SHAPES.A$300": POKE
232,0: POKE 233,3
1090 EF = 5
1100 PRINT D$ "OPEN STAR TABLE": PRINT D$ "REA
D STAR TABLE"
1110 INPUT NS
1120 FOR J = 1 TO NS: INPUT RA(J), DEC(J), MAG
(J), NAMES(J): NEXT J
1130 PRINT D$ "CLOSE STAR TABLE": PRINT D$: POKE
216,0: RETURN
1140 REM PARAMETER GET SUBROUTINE
1150 IF S1 = 0 AND S2 = 0 AND S3 = 0 AND S4 =
0 AND S5 = 0 AND S6 = 0 AND S7 = 0 AND S
8 = 0 AND S9 = 0 THEN RETURN
1160 IF S1 < > 1 THEN 1230
1170 PRINT
1180 CALL - 958: INPUT "LONGITUDE (DEG = -1
80 TO +180): ": LH$
1190 LH = INT ( VAL (LH$)): IF LEN (LH$) >
4 OR LH$ = "" OR LH < - 180 OR LH > 180
THEN PRINT G$: VTAB PEEK (37): HTAB
1: GOTO 1180
1200 CALL - 958: HTAB 16: INPUT "(MIN = 0 T
O 90): ": LM$
1210 LM = INT ( VAL (LM$)): IF LEN (LM$) >
2 OR LM$ = "" OR LM < 0 OR LM > 90 THEN
PRINT G$: VTAB PEEK (37): HTAB 1: GOTO
1200
1220 LNH = LH: LGM = LM: S4 = 1
1230 IF S2 < > 1 THEN 1270
1240 PRINT
1250 CALL - 958: HTAB 13: INPUT "LATITUDE (
0 TO 90): ": LT$
1260 LT = INT ( VAL (LT$)): IF LEN (LT$) >
2 OR LT$ = "" OR LT < 0 OR LT > 90 THEN
PRINT G$: VTAB PEEK (37): GOTO 1250
1270 IF S3 < > 1 THEN 1340
1280 PRINT
1290 CALL - 958: HTAB 9: INPUT "DATE (MONTH
= 1 TO 12): ": M$
1300 M = INT ( VAL (M$)): IF M < 1 OR M > 12
THEN PRINT G$: VTAB PEEK (37): HTAB
1: GOTO 1290
1310 CALL - 958: HTAB 16: PRINT "(DAY = 1 T
O "DD(M)"): ": INPUT "": DA$
1320 D = INT ( VAL (DA$)): IF D < 1 OR D > D
D(M) THEN PRINT G$: VTAB PEEK (37): HTAB
1: GOTO 1310
1330 MN = M: DAY = D: S4 = 1: IF S1 = 0 THEN GOSUB
2750
1340 IF S4 < > 1 THEN 1500
1350 TF = 1
1360 IF S1 = 0 OR S2 = 0 THEN GOSUB 2750
1370 PRINT
1380 CALL - 958: HTAB 12: INPUT "TIME (HR =
0 TO 23): ": SH$
1390 SH = INT ( VAL (SH$)): IF LEN (SH$) >
2 OR SH$ = "" OR SH < 0 OR SH > 23 THEN
PRINT G$: VTAB PEEK (37): HTAB 1: GOTO
1380
1400 CALL - 958: HTAB 16: INPUT "(MIN = 0 T
O 59): ": SM$
1410 SM = INT ( VAL (SM$)): IF SM$ = "" OR LEN
(SM$) > 2 OR SM < 0 OR SM > 59 THEN PRINT
G$: VTAB PEEK (37): HTAB 1: GOTO 1400
1420 IF S1 < > 1 THEN 1460
1430 LH = ABS (LH)
1440 LH = LH - 15: IF LH > = 0 THEN 1440
1450 LH = LH + 15: LH = LH + (LM / 60): LC = (L
H * 4) / 60: REM LC IS FACTOR TO SUBTRA
CT FROM STANDARD TIME TO GET LOCAL MEAN
TIME
1460 IF S4 < > 1 THEN 1500
1470 SH = SH + (SM / 60)
1480 IF LNH < 0 THEN MLT = SH + LC
1490 IF LNH > = 0 THEN MLT = SH - LC
1500 IF S3 < > 1 THEN 1640
1510 ON M GOTO 1630,1620,1610,1600,1590,1580
,1570,1560,1550,1540,1530,1520
1520 D = D + 30
1530 D = D + 31
1540 D = D + 30
1550 D = D + 31
1560 D = D + 31
1570 D = D + 30
1580 D = D + 31
1590 D = D + 30
1600 D = D + 31
1610 D = D + 28
1620 D = D + 31
1630 GST = 6.68 + (D * 4) / 60: IF GST > 24 THEN
GST = GST - 24: REM CALC GREENWICH SIDE
REAL TIME
1640 IF S4 < > 1 THEN 1700
1650 LST = MLT + GST: IF LST > 24 THEN LST =
LST - 24: REM CALC LOCAL SIDEREAL TIME
1660 HR = 0: MIN = 0
1670 MIN = INT (LST * 60)
1680 IF MIN < 60 THEN 1700
1690 HR = HR + 1: MIN = MIN - 60: GOTO 1680
1700 IF S5 < > 1 THEN 1860
1710 VTAB 23: CALL - 868: GOSUB 2450: VTAB
23: HTAB 1: INPUT "STAR NAME? ": T$

```

continued on page 52

LISTING 2: PLANETARIUM (continued)

```

1720 IF LEN (T$) = 0 THEN VTAB 23: HTAB 1:
    CALL - 958: GOTO 2220
1730 VTAB 24: HTAB 1: CALL - 868
1740 FL = 0: FOR I = 1 TO NS
1750 IF NAME$(I) = T$ THEN FL = I: I = NS
1760 NEXT
1770 IF FL = 0 THEN 1850
1780 XP = XC%(FL): YP = YC%(FL): IF MG(FL) < >
    99 THEN VTAB 23: HTAB 1: CALL - 868: HTAB
    1: PRINT G$"STAR NOT VISIBLE": FOR I = 1
    TO 500: NEXT I: GOTO 1710
1790 FOR Z = 1 TO 10: XDRAW 5 AT XP, YP
1800 FOR Y = 1 TO 200: NEXT Y
1810 XDRAW 5 AT XP, YP
1820 FOR X = 1 TO 200: NEXT
1830 NEXT Z
1840 GOTO 1710
1850 HTAB 1: VTAB 23: CALL - 868: HTAB 1: PRINT
    G$"STAR NOT IN TABLES": FOR I = 1 TO 500
    : NEXT I: GOTO 1710
1860 IF S6 < > 1 THEN 1910
1870 PRINT
1880 CALL - 958: INPUT "HORIZON (N = NORTH,
    S = SOUTH): ", HZ$
1890 IF HZ$ < > "N" AND HZ$ < > "S" THEN PRINT
    G$: VTAB PEEK (37): HTAB 1: GOTO 1880
1900 RETURN
1910 IF S7 < > 1 THEN 2130
1920 VTAB 23: CALL - 868: GOSUB 2440: XP = 1
    40: YP = 80: GOTO 1970
1930 IF YP < 2 THEN YP = 157
1940 IF YP > 157 THEN YP = 2
1950 IF XP < 2 THEN XP = 277
1960 IF XP > 277 THEN XP = 2
1970 GOSUB 2120
1980 KEY = PEEK ( - 16384): IF KEY < 128 THEN
    1980
1990 POKE - 16368, 0
2000 IF KEY = 205 THEN GOSUB 2120: YP = YP +
    1: GOTO 1940
2010 IF KEY = 201 THEN GOSUB 2120: YP = YP -
    1: GOTO 1930
2020 IF KEY = 202 THEN GOSUB 2120: XP = XP -
    1: GOTO 1950
2030 IF KEY = 203 THEN GOSUB 2120: XP = XP +
    1: GOTO 1960
2040 IF KEY = 155 THEN VTAB 23: CALL - 958
    : XDRAW 5 AT XP, YP: RETURN : REM RELOAD
    ARRAYS
2050 IF KEY < > 141 THEN 1980
2060 VTAB 23: HTAB 1: CALL - 868: PRINT "SE
    ARCHING ..."
2070 FL = 0: FOR I = 1 TO NS
2080 IF MG(I) = 99 AND YC%(I) > = YP - 1 AND
    YC%(I) < = YP + 1 AND XC%(I) > = XP -
    1 AND XC%(I) < = XP + 1 THEN VTAB 23: HTAB
    1: CALL - 868: PRINT "STAR IS - ": INVERSE
    : PRINT NAME$(I): NORMAL : FL = I: I = NS
2090 NEXT I
2100 IF FL = 0 THEN VTAB 23: HTAB 1: CALL
    868: PRINT G$"NO MATCH!"
2110 GOTO 1980
2120 XDRAW 5 AT XP, YP: RETURN
2130 IF S8 < > 1 THEN 2220
2140 EF = 3: ONERR GOTO 2350
2150 GOSUB 2750: INPUT "SAVE FILE NAME: ", AS$
    : NF = 1: IF LEN (AS$) > 0 THEN FOR NC =
    1 TO LEN (AS$): NA = ASC ( MIDS (AS$, NC, 1
    )): NF = ((NA > 64 AND NA < 91) OR (NA =
    46) OR (NA > 47 AND NA < 58)) AND NF = 1
    : NEXT : IF LEN (AS$) > 13 OR NF = 0 THEN
    VTAB 23: CALL - 868: PRINT G$"INVALID
    NAME": GOSUB 2760: GOTO 2150
2160 IF LEN (AS$) = 0 THEN POKE - 16303, 0:
    HOME : PRINT D$"CATALOG": PRINT : INPUT
    "PRESS <RETURN> TO CONTINUE ... ": BS: HOME
    : POKE - 16304, 0: VTAB 21: PRINT "LONG
    : "LNH" DEG "LGM" MIN LAT "LT" DEG"
    : PRINT TAB( 16)"DATE "MN"/"DAY: GOTO 2
    150
2170 PRINT D$"OPEN P."AS$
2180 PRINT D$"WRITE P."AS$
2190 PRINT LNH: PRINT LGM: PRINT LT: PRINT M
    N: PRINT DAY: PRINT LST: PRINT HR: PRINT
    MIN: PRINT HZ$
2200 PRINT D$"CLOSE P."AS$
2210 S8 = 0: POKE 216, 0: RETURN
2220 IF S9 < > 1 THEN S1 = 0: S2 = 0: S3 = 0:
    S4 = 0: S6 = 0: S8 = 0: S9 = 0: RETURN
2230 EF = 4: ONERR GOTO 2350
2240 GOSUB 2750: PRINT "LOAD FILE NAME (<RET
    URN> FOR CATALOG): " : INPUT "": AS$: NF = 1*
2250 IF LEN (AS$) > 0 THEN FOR NC = 1 TO LEN
    (AS$): NA = ASC ( MIDS (AS$, NC, 1)): NF = ((
    NA > 64 AND NA < 91) OR (NA = 46) OR (NA
    > 47 AND NA < 58)) AND NF = 1: NEXT : IF
    LEN (AS$) > 13 OR NF = 0 THEN VTAB 23: CALL
    - 868: PRINT G$"INVALID NAME": GOSUB 27
    60: GOTO 2240
2260 IF AS$ = "" THEN HOME : PRINT D$"CATALO
    G": PRINT : INPUT "PRESS <RETURN> TO CON
    TINUE ... ": BS: HOME : GOTO 2240
2270 IF LEFT$ (AS$, 2) = "P." THEN AS$ = MIDS
    (AS$, 3)
2280 PRINT D$"VERIFY P."AS$
2290 PRINT D$"OPEN P."AS$
2300 PRINT D$"READ P."AS$
2310 INPUT LNH, LGM, LT, MN, DAY, LST, HR, MIN, HZ$
2320 PRINT D$"CLOSE P."AS$
2330 TF = 0: SEC = 0: POKE 216, 0: RETURN
2340 REM ERROR HANDLING
2350 ER = PEEK (222): EL = PEEK (218) + 256 *
    PEEK (219): CALL - 3288: PRINT D$"CLOS
    E": TEXT : HOME : VTAB 12: IF ER = 6 THEN
    PRINT "FILE NOT ON THIS DISK": GOTO 243
    0
2360 IF (ER = 254 OR ER = 5) AND EF = 5 THEN
    PRINT "ERROR IN STAR TABLE": PRINT : PRINT
    "LAST STAR READ SUCCESSFULLY WAS:": PRINT
    : PRINT NAME$(J - 1): GOTO 2430
2370 IF ER = 4 AND EF = 3 THEN PRINT "THIS
    DISK IS WRITE-PROTECTED": GOTO 2430
2380 IF (ER = 4 OR ER = 6) AND EF < > 3 THEN
    PRINT "FILE NOT ON THIS DISK": GOTO 243
    0
2390 IF ER = 9 THEN PRINT "THIS DISK IS FUL
    L": GOTO 2430
2400 IF ER = 10 THEN PRINT "THE SPECIFIED F
    ILE IS LOCKED": GOTO 2430
2410 IF ER = 8 THEN PRINT "I/O ERROR. CHECK
    DRIVE DOOR": GOTO 2430
2420 PRINT "ERROR #"ER" IN LINE "EL"."
2430 PRINT : GOSUB 2760: HOME : ON EF GOTO 1
    90, 1060, 2140, 2230, 620
2440 VTAB 24: PRINT "I-J-K-M POSITION <RETUR
    N> <ESC>APE": RETURN
2450 VTAB 24: CALL - 868: VTAB 24: HTAB 1: PRINT
    "<RETURN> TO RESUME": RETURN
2460 CF = 0
2470 TEXT : HOME : HTAB 15: INVERSE : PRINT
    "SETUP MENU": NORMAL
2480 S1 = 0: S2 = 0: S3 = 0: S4 = 0: S5 = 0: S6 =
    0: S7 = 0: S8 = 0: S9 = 0
2490 PRINT : HTAB 5: PRINT "1. LONGITUDE:":
    HTAB 20: INVERSE : PRINT LNH: NORMAL :
    PRINT " DEG ": INVERSE : PRINT LGM: NORMAL
    : PRINT " MIN"
2500 PRINT : HTAB 5: PRINT "2. LATITUDE: "
    : HTAB 20: INVERSE : PRINT LT: NORMAL
    : PRINT " DEG"
2510 PRINT : HTAB 5: PRINT "3. DATE:": HTAB
    20: INVERSE : PRINT MN/"DAY: NORMAL
2520 PRINT : HTAB 5: PRINT "4. SID. TIME:":
    HTAB 20: INVERSE : PRINT HR: LEFT$ ("0
    ".1 + (MI < 10))MIN: NORMAL : IF NOT T
    F THEN PRINT
2530 IF TF THEN PRINT " (" INT (SH): LEFT$
    ("0".1 + (SM < 10))SM" INPUT)"
2540 PRINT : HTAB 5: PRINT "5. HORIZON:": HTAB
    20: INVERSE : PRINT HZ$: NORMAL
2550 PRINT : HTAB 5: PRINT "6. PLOT MODE:":
    HTAB 20: INVERSE : PRINT MD$(PFLAG): NORMAL
2560 PRINT : HTAB 5: PRINT "7. SAVE PARAMETE
    RS TO DISK"
2570 PRINT : HTAB 5: PRINT "8. LOAD PARAMETE
    RS FROM DISK"
2580 PRINT : HTAB 5: PRINT "9. QUIT"
2590 SL = 1: PX = 29: MX = 9
2600 VTAB 24: HTAB 1: PRINT "<ESC> TO RETURN
    TO STAR SCREEN":
2610 VTAB 21: HTAB 1: PRINT "USE ARROWS OR S
    ELECT NUMBER: "

```

```

2620 POKE - 16368,0: GOSUB 2770
2630 IF Z = 20 THEN ON CF GOTO 300: POKE
      16304,0: GOTO 520
2640 IF Z = 10 THEN CF = 1
2650 ON SL GOTO 2660,2670,2680,2690,2700,271
      0,2720,2730,2740
2660 S1 = 1: GOSUB 2750: GOSUB 1140: GOTO 247
      0
2670 S2 = 1: GOSUB 2750: GOSUB 1140: GOTO 247
      0
2680 S3 = 1: GOSUB 2750: GOSUB 1140: GOTO 247
      0
2690 S4 = 1: GOSUB 2750: GOSUB 1140: GOTO 247
      0
2700 S6 = 1: GOSUB 2750: GOSUB 1140: GOTO 247
      0
2710 PFLAG = 1 - PFLAG: GOSUB 2750: GOTO 2470
2720 S8 = 1: GOSUB 2130: GOTO 2470
2730 S9 = 1: GOSUB 2220: GOTO 2470
2740 GOTO 610
2750 VTAB 21: HTAB 1: CALL - 958: VTAB 21: RETURN

2760 VTAB 24: HTAB 6: PRINT "PRESS <RETURN>
      TO CONTINUE": GET Z$: PRINT: RETURN
2770 N = SL: OS = SL: GOSUB 2800: Z = 0: VTAB 2
      1: HTAB PX: CALL - 868
2780 VTAB 21: HTAB PX: PRINT SL: GET Z$: IF
      Z$ > "1" AND Z$ < "STR$(MX)" THEN
      SL = VAL (Z$): N = OS: GOSUB 2800: GOTO
      2770
2790 Z = (Z$ = CHR$(21) OR Z$ = CHR$(10))
      - (Z$ = CHR$(8) OR Z$ = CHR$(11)) +
      10 * (Z$ = CHR$(13)) + 20 * (Z$ = CHR$
      (27)): ON NOT Z GOTO 2780: SL = SL + Z *
      (Z < 10): SL = SL - MX * (SL > MX) + MX *
      (SL < 1): N = OS: GOSUB 2800: ON Z < 10 GOTO
      2770: RETURN
2800 VTAB 1 + 2 * N: HTAB 1: PRINT X$(SL = 0
      S): RETURN
END OF LISTING 2

```

KEY PERFECT
RUN ON
PLANETARIUM

CODE-5 0	LINE# - LINE#	CODE-4 0
8F5237B4	10 - 100	BBB4
8FBEC730	110 - 200	AB8D
7479E323	210 - 300	E81C
0ACCA786	310 - 400	89E2
0A796B40	410 - 500	5F42
E5BC4946	510 - 600	9616
2D93FBB1	610 - 700	B3CD
401632D6	710 - 800	7302
05515AD3	810 - 900	9E9B
0A21741F	910 - 1000	B1A1
0D593CE1	1010 - 1100	71C9
17B342F1	1110 - 1200	987D
DE10C453	1210 - 1300	912A
E5FB6A93	1310 - 1400	8AE2
1A120160	1410 - 1500	9120
4FBAC240	1510 - 1600	4E5E
93B86015	1610 - 1700	752E
80B9094E	1710 - 1800	8517
15EC4857	1810 - 1900	5B4E
1409F4CA	1910 - 2000	576B
98D996BE	2010 - 2100	AF4D
F4A99CDB	2110 - 2200	E031
9F8F78F8	2210 - 2300	C580
B9ECCFA0	2310 - 2400	E94F
8026FB8E	2410 - 2500	BFE1
3BD3434B	2510 - 2600	BA00
5809B745	2610 - 2700	8856
AD40B8CC	2710 - 2800	CA56
C5ED4E48	PROGRAM TOTAL =	

LISTING 3: STAR.SHAPE

```

0300- 09 00 14 00 20 00 2B 00
0308- 31 00 33 00 3F 00 4D 00
0310- 5C 00 6D 00 2D 04 18 33
0318- 39 37 37 29 35 2B 00 05
0320- 24 15 2A 1E 33 07 18 08
0328- 3F 00 00 2C 32 3B 20 00
0330- 00 05 00 18 08 2D 36 36
0338- 3F 3F 24 24 2D 00 2A 24
0340- 24 24 14 12 29 2A 2A 12
0348- 24 24 24 04 00 24 24 24
0350- 14 29 2D 16 1A 3F 17 12
0358- 29 2D 05 00 24 24 24 14
0360- 12 12 0A 05 20 0E 32 21
0368- 24 24 24 00 20 30 29 25
0370- 21 1C 3F 07 20 0C 2D 15
0378- 05 00

```

END OF LISTING 3



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	On Target	•	•	•	•	•
Baedeker's Travelware	Correct Behavior France	•	•	•	•	•
	Correct Behavior Germany	•	•	•	•	•
	Correct Behavior Mexico	•	•	•	•	•
	Correct Behavior Japan	•	•	•	•	•

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