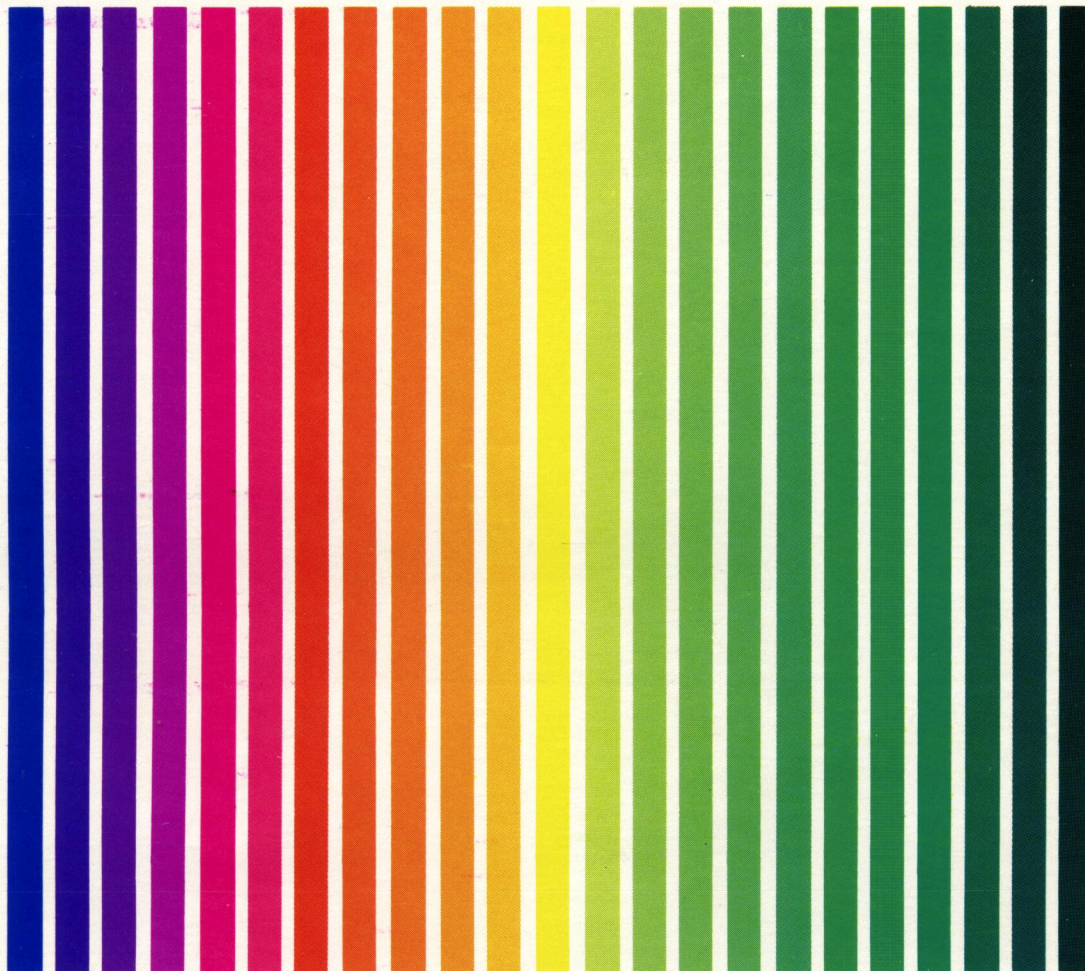# ⊂PX
ATARI® PROGRAM EXCHANGE

Harry Koons and Art Prag

STARWARE
Sky map generator and constellation quiz (teens and up)

Diskette: 40K (APX-20111)

User-Written Software for ATARI Home Computers

STARWARE

by

Harry Koons and Art Prag

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1   INTRODUCTION

Overview

Explore the night sky with your personal computer. With the STARWARE program
you can display the stars on your video screen with the brilliance normally seen by
astronomers at remote mountaintop observatories. This unique astronomy program
includes approximately 900 star coordinates which accurately locate all of the
constellations in both the Northern and Southern Hemispheres. You will quickly
learn to identify the constellations. You can display high resolution diagrams of
each constellation as well as high resolution maps of the heavens visible from your
home at any date and time this century. Even the bright planets, sun and moon are
accurately located with respect to the stars. The maps can be drawn twice. The first
time only the stars are shown. The second time the lines defining each constellation
are drawn. The program prompts you for the input data that is needed for each map.
It takes about four and one-half minutes to draw each high resolution map on the
screen. Other options allow you to display a single constellation. There is also a
quiz. A constellation chosen at random is displayed on the screen. You are then
asked to identify the constellation. For beginners a multiple-choice list is provided.
In a couple of hours it is possible to learn all of the constellations in the sky. For
the amateur astronomer the program quickly calculates Local Sidereal Time. This
allows you to set the hour circle on your telescope without spending time using
calibration stars. A "finder" option allows you to specify the Right Ascension and
Declination at the center of the map and the size of the field of view. This can be
used to locate objects listed in astronomy books. It can also be used to locate
comets as they are discovered.

Minimum RAM and accessories

To use the STARWARE programs, you will need the following ATARI equipment:

> REQUIRED ACCESSORIES
>   40K RAM
>   ATARI 810 Disk Drive
>   ATARI BASIC Language Cartridge

2   GETTING STARTED

Set up your equipment and load the program as follows:

1. Install an ATARI BASIC (Computing Language) Cartridge into the LEFT cartridge
slot in the computer console.

2. Insure that the computer power is OFF.

3. Turn on disk drive and wait for the BUSY light on the disk drive to go off.

4. Turn on TV or monitor.

5. Insert the STARWARE PROGRAM diskette into the disk drive and close the disk drive door.

6. Switch the POWER switch on the computer console to ON. After a short period of loading the disk operating system, the READY prompt will appear on the television screen.

7. Shortly a logo will appear on the screen giving the program name – STARWARE, the author, and the version number. The logo will remain on the screen while the STARWARE program loads into computer memory.

8. After the STARWARE program is loaded, star location data is loaded into the computer from the disk while the message LOADING STAR POINTERS appears on the screen.

9. Finally the STARWARE selection menu appears on the screen. You are now ready to begin to use the STARWARE programs.

Selecting a program

The STARWARE programs consist of six individual programs. Each individual program is listed on your selection menu with a letter preceeding the program name. The main STARWARE menu is the first menu to appear on the screen and it looks like this:

        *** STARWARE ***

        T - TONIGHT'S SKY
        C - CONSTELLATIONS
        L - LOCAL SIDEREAL TIME
        Q - CONSTELLATION QUIZ
        F - FINDER
        P - PLANETS, SUN & MOON

    ENTER CHOICE?

Choose your program selection, and type its designated letter followed by [RETURN]. The prompts for the input data will then appear on the screen.

Entering data

The format for the input data is described in Section 9 – INPUT DATA FORMAT. Please refer to that section while you are learning to use the options described below.

Error messages

If STARWARE encounters an error which the BASIC language recognizes, the BASIC error number will appear on the screen and the program will end. To rerun STARWARE, follow the "GETTING STARTED" instructions on page 1.

3   TONIGHT'S SKY

The TONIGHT'S SKY option allows you to display on the screen a map of the stars
and planets as seen from any location on the earth at any time between the years
1900 and 2000. Approximately one-quarter of the sky is drawn at one time. You
choose the direction the observer is looking: north, south, east, west or at zenith.

When you enter T as your choice under the STARWARE menu you will immediately be
prompted for the input data needed to generate your star map. To generate a map
under this option, you must be prepared to enter the following data:

    *Date:
        Month
        Day
        Year
    *Time:
        Time zone conversion
        Hour
        Minutes
        Seconds
        AM, PM or 24 hour system
    *East Longitude
    *Latitude
    *Look direction

Each of these parameters is defined in Section 9 below together with detailed
instructions on how to enter the data. Please refer to that section as the prompts
for data appear on the screen.

After you have entered the data the program is ready to begin drawing the map.
When you type [RETURN] to enter the look direction, the screen will go blank and
data will begin to load into the computer's memory from the disk. The message:

    Plotting Stars

will appear at the bottom of the screen. It may be some time before the first stars
begin to appear. The constellations are plotted in alphabetical order. The program
must search through all of the stars to find the ones that are plotted in the section
of the sky you have chosen. After about four and one-half minutes the disk drive
will turn off and the message on the screen will change to:

    Plotting Planets

Now the program is calculating the locations for the moon, the sun, Mercury, Venus,
Mars, Jupiter, and Saturn. Each is plotted in turn as the location is determined. The
sun and moon are plotted last. If the sun is plotted on the screen, the sky color is
changed to blue. If the sun is not in your field of view on the screen, the background

will remain black even though it may be daytime. It is of course possible that none of these objects are in the portion of the sky that you have chosen.

When the map is done the following message will appear on the screen:

Type [RETURN] to draw constellations?

If you do not want to have the constellations drawn, you may type M [RETURN] and the program will return to the STARWARE menu.

If you just type [RETURN] the program will go through the data on the disk again and draw the lines defining the constellations. While it is doing this the following message is displayed on the screen:

Drawing Constellations

After the constellations have all been drawn, the following message will appear on the screen:

Type [RETURN] for menu

When you type [RETURN], the program will display the STARWARE menu.

If you want to look in a different direction at the same time and location, select T again as your choice under the STARWARE menu. The following prompt will appear on the screen:

DO YOU WANT THE SAME TIME
AND LOCATION (Y OR N)?

If you enter N you will be prompted to enter a new time and location. If you enter Y you will only be prompted to enter a new look direction. The program will use the same time and location as was used for the previous starmap.

Note: At any time that the program is plotting stars or drawing constellations you can stop the program and proceed to the next step by holding down the yellow [OPTION] key. This will not work when the program is plotting planets.

Star Images

The brightness of a star is called its magnitude. A star of the first magnitude is about two and one-half times as bright as one of second magnitude and 100 times as bright as one of fifth magnitude. Many stars as faint as fifth magnitude are included in the constellations drawn by the STARWARE programs.

The size of the image of each star drawn by the program is an indication of the brightness of the star. The faintest stars with magnitudes between 3.0 and about 5.0 are drawn as a single point (pixel). Intermediate magnitudes from 1.5 to 3.0 are

drawn as four adjacent pixels forming a small white square. The brightest stars with magnitudes from -1.5 to 1.5 are drawn as nine adjacent pixels forming a large square on the screen.

The brightest star in the sky is Sirius at magnitude -1.5 in the constellation Canis Major. If you display Canis Major using the CONSTELLATIONS program you will see examples of all three brightness levels. The largest star displayed in that constellation is Sirius.

4   CONSTELLATIONS

The CONSTELLATIONS option allows you to display a single constellation of your choice on the screen. There are 66 constellations available to be displayed. To select a constellation you must enter the three letter abbreviation for the constellation. A list of the constellations can be displayed on the screen to help you if you do not know or remember the abbreviation for the constellation that you want' to display.

When you enter C as your choice under the STARWARE menu, a short description of the constellation menu appears on the screen. The constellation menu is in alphabetical order and requires two pages of screen display. The following prompt appears at the bottom of the screen:

    Enter number of page,
    three letter abbreviation,
    or [RETURN] for main
    STARWARE menu?

If you know the correct three-letter abbreviation simply enter it, then type [RETURN]. For example, for the constellation Orion type:

    ORI [RETURN]

If you do not know the correct abbreviation type the page number. For example, Orion falls between Hydrus and Vulpecula in the alphabet. Therefore, it is listed on page two of the constellation menu. To display that page type:

    2 [RETURN]

The screen will then display an alphabetical list of the constellations from Hydrus to Vulpecula. In front of each name will be the three-letter abbreviation used by the STARWARE program to identify the constellation. At the bottom of the screen the following prompt is displayed:

    Enter 3 letters to see constellation.
    Type P for other page or main menu.

    ENTER CHOICE?

If you type the wrong page number or want to return to the main STARWARE menu type P. This will return you to the short description of the constellation menu. From there you can select the other page or return to the main menu.

Otherwise, proceed by selecting the constellation that you want from the list. Type the three letters identifying the constellation followed by [RETURN]. For example, to see Pegasus type:

PEG [RETURN]

The program will take a few seconds to locate the constellation on the disk. The screen will then go blank and data will begin to load into the computer's memory from the disk. The message:

Plotting Stars

will appear at the bottom of the screen. It will only take a few seconds to plot all of the stars for the constellation you have selected. When the plot is done, the following message will appear on the screen:

Type [RETURN] to draw constellations?

If you do not want to draw this constellation, you may type M [RETURN] and the program will return to the constellation menu.

If you just type [RETURN] the program will go through the data on the disk again and draw the lines defining the constellation that is displayed on the screen. Again this will only take a few seconds. While it is doing this, the following message is displayed on the screen:

Drawing constellations

After the drawing is finished, the following message will appear on the screen:

Type [RETURN] for menu

When you type [RETURN], the program will display the constellation menu. You must return to this menu to display another constellation.

If you then want to display another constellation, either type in another three-letter abbreviation or a page number for the list of constellations as described above. If you want to display the main STARWARE menu simply type [RETURN].

5 LOCAL SIDEREAL TIME

Local Sidereal Time is the hour circle of Right Ascension on the observer's meridian. The LOCAL SIDEREAL TIME option allows you to compute this for any clock time and any longitude on the earth. This time is used by astronomers to set the hour circle on a telescope. This option will be very useful for the amateur astronomer who would previously have to calculate the value from a table or use bright stars of known location to set his hour circle.

When you enter L as your choice under the STARWARE menu, you will immediately be prompted for the input data needed to compute local sidereal time. You must be prepared to enter the following data:

    *Date:
        Month
        Day
        Year
    *Time:
        Time zone conversion
        Hour
        Minutes
        Seconds
        AM, PM or 24 hour system
    *East Longitude

Each of these parameters is defined in Section 9 below together with detailed instructions on how to enter the data. Please refer to that section as the prompts for data appear on the screen.

After you have entered all of the data, the program computes the local sidereal time at the clock time and location you selected. The result is displayed on the screen.

When you are ready to return to the STARWARE menu, simply type [RETURN].

6 CONSTELLATION QUIZ

The CONSTELLATION QUIZ option displays one constellation at a time from the 66 available and asks you to identify it. There is a beginner's level where four choices (we call them hints) are given on the screen. There is also an advanced level where no choices are given. You must enter the three-letter abbreviation from memory.

When you enter Q as your choice under the STARWARE menu, a new screen display asks you to select either the beginner's or the advanced level. At the prompt, enter A [RETURN] for the advanced or B [RETURN] for the beginner's level.

The program will take a few seconds to select a constellation at random and plot the stars on the screen. The following message will then be displayed:

    Enter three letter abbreviation

    You enter the three-letter abbreviation for the constellation followed by typing [RETURN]. The correct answer for the beginner's level is one of the four choices listed on the screen. If your answer is correct, the program will draw the constellation and prompt you to type [RETURN] for a new quiz or M [RETURN] to display the STARWARE menu. If your answer is wrong, a buzzer will sound and you can try another three-letter abbreviation. If you fail to get the right answer in three tries, the correct answer is shown and the constellation outline is drawn. You may then continue with another quiz or return to the main menu.

7 FINDER

The FINDER option allows you to display a map of the stars in a portion of the celestial sphere. You choose the coordinates for the center of the map and the size of the field of view. The computer then plots all of the stars in that area. A small cross is placed in the center of the field of view. This simulates the cross-hairs in the finder scope of an astronomical telescope. This option can be used to help locate objects which are not included in the data on the disk. In the appendix is a list of some of the 110 "nebulae" in Charles Messier's famous catalogue. You can use the finder option to locate these objects with respect to the constellations.

When you type F as your choice under the STARWARE menu, you will immediately be prompted for the input data needed to generate the star map. To generate a map under this option you must be prepared to enter the following data:

    *Right Ascension at the center of the map
    *Declination at the center of the map
    *Field of View in degrees

Each of these parameters is defined in Section 9 together with detailed instructions on how to enter the data. Please refer to that section as the prompts for data appear on the screen.

After you have entered the data the program is ready to begin plotting the map. When you type [RETURN] to enter the size of the field of view, the screen will go blank and data will begin to load into the computer's memory from the disk. The message:

    Plotting Stars

will appear at the bottom of the screen. It may be some time before the first stars begin to appear. The constellations are plotted in alphabetical order. The program must search through all of the stars to find the ones that are plotted in the section of the sky you have chosen. After about four and one-half minutes the disk drive will turn off and the message on the screen will change to:

    Type [RETURN] to draw constellations.

If you do not want to have the constellations drawn you may type M [RETURN] and the program will return to the STARWARE menu.

If you just type [RETURN] the program will go through the data on the disk again and draw the lines defining the constellations. While it is doing this, the following message is displayed on the screen:

    Drawing Constellations

After the constellations have all been drawn the following message will appear on the screen:

Type [RETURN] for menu

When you type [RETURN], the program will display the STARWARE menu.

Note: The planets are not plotted under the finder option because the date and time are not used to define the map.

8 PLANETS, SUN & MOON

The PLANETS, SUN & MOON option will place the object of your choice in the center of the star map. You must specify the date and time and the map will then show the stars and the other objects that are visible about the one you have placed in the center of the map.

When you type P as your choice under the STARWARE menu, you will immediately be prompted for the input data needed to generate the star map. To generate a map under this option you must be prepared to enter the following data:

    *Name of the object to be placed at the center of the map
    *Date:
        Month
        Day
        Year
    *Time:
        Time zone conversion
        Hour
        Minutes
        Seconds
        AM, PM or 24 hour system
    *Field of View in degrees

Each of these parameters is defined in Section 9 together with detailed instructions on how to enter the data. Please refer to that section as the prompts for data appear on the screen.

There is a short pause after you enter the time and before you enter the field of view while the location of the object in the sky is being computed. The message LOCATING OBJECT appears on the screen during this pause.

After you have entered all of the data, the program is ready to begin plotting the map. When you type [RETURN] to enter the size of the field of view, the screen will go blank and data will begin to load into the computer's memory from the disk. The message:

    Plotting Stars

will appear at the bottom of the screen. It may be some time before the first stars begin to appear. The constellations are plotted in alphabetical order. The program must search through all of the stars to find the ones that are plotted in the section of the sky you have chosen. After about four and one-half minutes the disk drive will turn off and the message on the screen will change to:

Plotting Planets

Now the program is calculating the locations for the moon, sun and bright planets.
Each is plotted in turn as the location is determined. The sun and moon are plotted
last. If the sun is plotted on the screen,the sky color is changed to blue. The object
you selected will now be located in the center of the map.

When the map is done,the following message will appear on the screen:

    Type [RETURN] to draw constellations.

If you do not want to have the constellations drawn,you may type M [RETURN] and
the program will return to the STARWARE menu.

If you just type [RETURN],the program will go through the data on the disk again
and draw the lines defining the constellations. While it is doing this,the following
message is displayed on the screen:

    Drawing Constellations

After the constellations have all been drawn,the following message will appear on
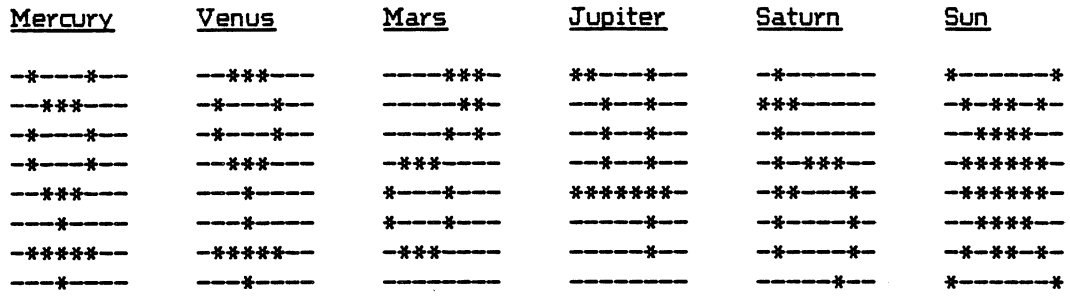the screen:

    Type [RETURN] for menu

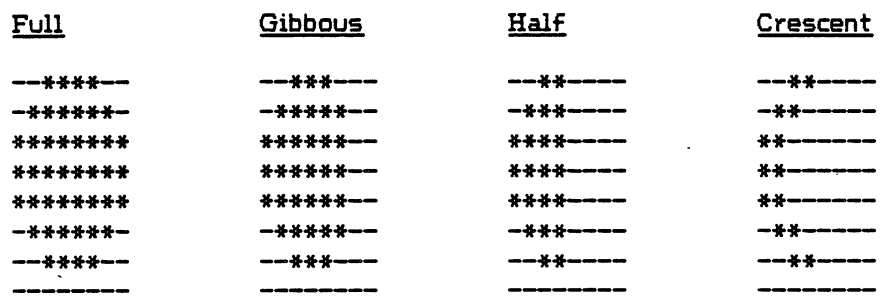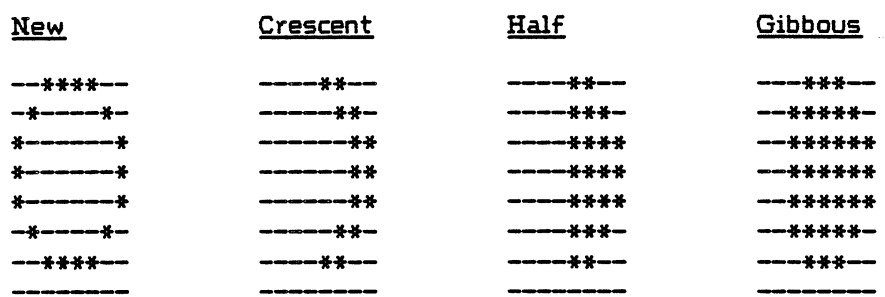When you type [RETURN], the program will display the STARWARE menu.

Note: It is interesting to use this option to plot times when solar eclipses or
planetary conjunctions occur. Because character graphics are used for the planets,
they are not as accurately located on the screen as are the stars. However, if the
field of view is greater than 30 degrees,they will be plotted within one character
(eight pixels) of the correct location. The accuracy of the computed location is about
1/2 degree in the sky from 1900 to 2000 A.D. Most of the planets are in the daytime
sky during October of 1981. Choose a date during that month and select the sun as
the object to be centered in your map. You should then find the planets stretched out
across the screen.

Graphics

Graphics characters are used to display the planets, sun and moon. Each character
contains 64 pixels in an 8 * 8 array. Eight phases of the moon are shown including
new, cresent, one-half, three quarters, and full. The symbols on the following page
are used for the planets

Mercury	Venus	Mars	Jupiter	Saturn	Sun

```
Mercury    Venus      Mars       Jupiter    Saturn     Sun

-*---*--   --***---   ----***-   **---*--   -*------   *------*
--***---   -*---*--   -----**-   --*--*--   ***-----   -*-**-*-
-*---*--   -*---*--   ----*-*-   --*--*--   -*------   --****--
-*---*--   --***---   -***----   --*--*--   -*-***--   -******-
--***---   ---*----   *---*---   *******-   -**---*-   -******-
---*----   ---*----   *---*---   -----*--   -*----*-   --****--
-*****--   -*****--   -***----   -----*--   -*----*-   -*-**-*-
---*----   ---*----   --------   --------   -----*--   *------*
```

The following symbols are used for the phases of the moon:

```
New            Crescent        Half            Gibbous

--****--       ----**--        ----**--        ---***--
-*----*-       -----**-        ----***-        --****--
*------*       ------**        ----****        --******
*------*       ------**        ----****        --******
*------*       ------**        ----****        --******
-*----*-       -----**-        ----***-        --****--
--****--       ----**--        ----**--        ---***--
--------       --------        --------        --------
```

```
Full           Gibbous         Half            Crescent

--****--       --***---        --**----        --**----
-******-       -*****--        -***----        -**-----
********       ******--        ****----        **------
********       ******--        ****----        **------
********       ******--        ****----        **------
-******-       -*****--        -***----        -**-----
--****--       --***---        --**----        --**----
--------       --------        --------        --------
```

9 INPUT DATA FORMAT

The STARWARE program will prompt you for the data needed to make each map. Data is requested by a ? at the end of a line. When data is requested, type the data in the format described below then press the [RETURN] key. In these instructions we will use the symbol [RETURN] to remind you that this is one key. The computer will not act on any data entered until the [RETURN] key is pressed.

All of the items listed here are not needed for each map. Use this section as a reference as the prompts you need appear on the screen.

DATE:

MONTH

You may either enter the number of the month from 1 to 12, or one of the following three-letter abbreviations: JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV or DEC.

DAY

You must enter the number of the day of the month. The number should be between 1 and 31.

YEAR

You may enter the full year such as 1981 or you may abbreviate the year like 81. If you abbreviate the year 1900 is added to the number you enter.

LOCAL TIME:

TIME ZONE CONVERSION

You must enter a number which is equal to the number of time zones from the prime meridian through the Royal Observatory in Greenwich, England to your time zone. If you are west of the prime meridian you enter the number as a positive number. If you are east of the prime meridian you enter the number as a negative number. A menu of values for several time zones is displayed on the screen. Find your time zone on the screen and type the number that corresponds with your time zone. Note that the number changes between standard time and daylight savings time.

The abbreviations on the screen stand for the following time zones:

    EST - Eastern Standard Time
    EDT - Eastern Daylight Time
    CST - Central Standard Time
    CDT - Central Daylight Time

MST - Mountain Standard Time
MDT - Mountain Daylight Time
PST - Pacific Standard Time
PDT - Pacific Daylight Time
GMT - Greenwich Mean Time
BST - British Summer Time
WET - Western European Time
UT - Universal Time
CET - Central European Time
EET - Eastern European Time

HOUR

Enter the hour of the day by entering a number between 0 and 12 if you are using a twelve hour clock or between 0 and 24 if you are using a twenty-four hour clock.

MINUTES

Enter a number between 0 and 59

SECONDS

Enter a number between 0 and 59

Note: For minutes and seconds you must enter a number. You will get an error message and will have to start over if you just type [RETURN].

AM, PM or 24

If you are using a twelve-hour clock enter AM for times before noon or PM for noon or times after noon. If you are using a twenty-four hour clock enter 24.

Latitudes and longitudes

The stars that you see in the night sky differ depending upon your location on earth. The STARWARE program must know your location in order to draw some of the star maps. Distance north and south of the earth's equator is measured along a meridian. It is expressed in degrees and is called latitude. A circle around the world at constant latitude is called a parallel. Distance along a parallel is also measured in degrees and is called longitude. By international agreement the meridian that passes through the Royal Observatory in Greenwich, England, is used as the prime meridian. The longitude of any place on that meridian is 0(zero) degrees. For the STARWARE program the longitudes required to set up the star maps for TONIGHT'S SKY must be entered as east longitudes, i.e. the longitude measured in degrees east from Greenwich. This will range from 0 to 360 degrees. Many maps, especially those of the Western Hemisphere, are labeled in west longitude. A west longitude may be entered into the program at the prompt for the east longitude. To do that you type a minus sign in front of the west longitude.

EAST LONGITUDE

If you are located in Los Angeles your east longitude is 240 degrees. This corresponds with 120 degrees west longitude. At the prompt:

    EAST LONGITUDE
    in DEGREES

you would enter the east longitude in the form:

    240 [RETURN]

You could also have entered the west longitude in the form:

    -120 [RETURN]

LATITUDE

The latitude of Los Angeles is 34 degrees north of the equator. The program requires the north latitude. For places south of the equator enter the latitude as a negative number by typing a minus sign before the value. For Los Angeles at the prompt

    NORTH LATITUDE
    in DEGREES

you enter the latitude in the form:

    34 [RETURN]

Right Ascension and Declination

The location of stars in the sky is measured in much the same type of coordinate system as locations on earth. Astronomical positions are measured on the celestial sphere. Distance north and south of the celestial equator is measured along an hour circle. It is measured in degrees and is called declination. An hour circle through the zenith is equivalent to a meridian in geographic coordinates. A circle around the celestial sphere at constant declination is called a parallel of declination. Distance along a parallel is called Right Ascension. The Right Ascension of an object is the angle between the hour circle through the object and the First Point of Aries. It is measured eastward usually in units of time (hours, minutes, seconds). One hour is equivalent to 15 degrees, one degree to 4 minutes of time.

RIGHT ASCENSION

When the prompt:

**RIGHT ASCENSION
in HOURS**

appears on the screen you must enter the right ascension as a decimal number in hours. For example, the right ascension of the famous Crab nebula(M1) is 5 hrs 31 min 30 sec. You can convert this to hours using the following formula:

R.A. [hrs] = hrs + (min/60) + (sec/3600)

For the Crab nebula:

R.A. [hrs] = 5 + (31/60)+ (30/3600) = 5.525

You would thus enter the value:

5.525 [RETURN]

DECLINATION

When the prompt:

**DECLINATION
in DEGREES**

appears on the screen you must enter the declination as a decimal number in degrees. For example, the declination of the Crab nebula is 21 deg 59 min North. You can convert this to degrees using the following formula:

DECLINATION [deg] = deg + (min/60) + (sec/3600)

For the Crab nebula:

DECLINATION [deg] = 21 + (59/60)+ (0/3600) = 21.98

You would thus enter the value:

21.98 [RETURN]

You enter the number as a positive number because the Crab nebula is north of the celestial equator. For objects south of the celestial equator type a minus sign before the value of the declination.

LOOK DIRECTION

When the look-direction menu is on the screen, you type the letter corresponding to the compass direction for which you want the star map plotted. The zenith direction is straight up. When you choose zenith the top of the screen shows stars to the north and the bottom of the screen shows stars to the south. For the compass

directions the center of the star map is about 45 degrees above the horizon and the field of view is about 90 degrees.

FIELD OF VIEW

The field of view is the size of the area of the sky to be plotted. It is measured in degrees. The larger the field of view the more distortion will appear at the edges of the screen. This is similar to the effect of taking a picture with a fish-eye lens. When you try to take a picture of a very large field of view the objects at the edge appear rotated and distorted. A special projection has been used to minimize this effect and make the constellations appear relatively undistorted for very large fields of view. A field of view of 20 degrees will usually contain two or three constellations. This is about the minimum size you can use and still have enough stars to recognize a constellation. A field of view of 180 degrees includes the whole sky. This is too large a field of view to be very practical. Over 400 stars will be plotted on the screen. Fields of view around 60 degrees are best while you are learning to use the STARWARE programs. After you become familiar with the star maps that are plotted, you can try larger and smaller fields of view.

When the prompt:

    FIELD OF VIEW
    in DEGREES

appears on the screen, type a value in the form:

    60 [RETURN]

The field of view must always be a positive number.

10 REFERENCES

A good introduction to astronomy can be found in an encyclopaedia. For example:

New Encyclopaedia Britannica, Helen Hemingway Benton, Chicago, 1974.

The locations of the stars for the STARWARE program were obtained from:

Apparent Places of Fundamental Stars - 1980, Astronomisches Rechen-Institut, Heidelberg, 1978

The American Ephemeris and Nautical Almanac for the Year 1980, U.S. Government Printing Office, Washington, D.C., 1979

and

Atlas Coeli II, Katalog 1950.0, ed. Antonin Becvar, Ceskoslovenske Akademie Ved, Prague, 1960.

The constellations have been drawn according to the figures in:

Atlas of the Sky, Vincent de Callatay, trans. Sir Harold Spencer Jones. K.B.E., St. Martin's Press, New York, 1959.

Note: Almost all of the stars are located for Epoch 1980.0. A few that were required for the constellation drawings and that were not found in the 1980 catalogues are located for Epoch 1950.0 The differences are not significant for fields of view greater than a few degrees.

APPENDIX — MESSIER OBJECTS

In the 18th century, Charles Messier, a French Astronomer, published a catalogue of nebulae. His list was intended as a guide for astronomers searching for comets. Many of the objects are bright enough to be seen with binoculars or a small telescope. A few can be seen with the naked eye. This list contains the finest deep-sky objects in his final catalogue. The object number is followed by the name of the constellation in which the object is located. The first number in the parenthesis is the Right Ascension of the object. The second number is the Declination of the object. These numbers can be entered into the FINDER option to display the star field around the object.

M1-Taurus, [5.53, 22.0], the Crab nebula, a supernova remnant
M2-Aquarius, [21.5, -1.1], globular cluster
M3-Canes Venatici, [13.67, 28.6], globular cluster
M4-Scorpius, [16.34, -26.4], conspicuous globular cluster near the star Antares
M5-Serpens, [15.27, 2.3], bright globular cluster
M6-Scorpius, [17.61, -32.2], galactic cluster
M7-Scorpius, [17.85, -34.8], galactic cluster
M8*-Sagittarius, [18.03, -24.3], Lagoon nebula
M10-Ophiuchus, [16.91, -4.0], globular cluster
M11-Scutum, [18.80, -6.3], galactic cluster
M12-Ophiuchus, [16.75, -1.9], globular cluster
M13*-Hercules, [16.67, 36.6], one of the finest globular clusters
M15-Pegasus, [21.47, 12.0], globular cluster
M17-Sagittarius, [18.30, -16.2], Omega or Horseshoe nebula
M22-Sagittarius, [18.55, -24.0], globular cluster
M23-Sagittarius, [17.90, -19.0], galactic cluster
M27-Vulpecula, [19.95, 22.6], Dumbbell nebula
M31*-Andromeda, [0.67, 41.0], great Andromeda spiral galaxy
M35-Gemini, [6.10, 24.3], galactic cluster
M37-Auriga, [5.82, 32.6], galactic cluster
M42*-Orion, [5.55, -5.4], magnificent nebula in Orion
M44-Cancer, [8.63, 19.87], Beehive star cluster
M45-Taurus, [3.73, 23.97], the Pleiades a bright galactic cluster
M46-Puppis, [7.67, -14.7], galactic cluster
M51-Canes Venatici, [13.47, 47.4], famous Whirlpool galaxy
M55-Sagitarrius, [19.62, -31.0], globular cluster
M57-Lyra, [18.87, 33.0], Ring nebula
M64-Coma Berenices, [12.90, 21.8], spiral galaxy
M67-Cancer, [8.80, 12.0], galactic cluster
M81-Ursa Major, [9.87, 69.3], spiral galaxy
M82-Ursa Major, [9.87, 69.9], irregular galaxy
M92-Hercules, [17.27, 43.2], globular cluster
M94-Canes Venatici, [12.81, 41.4], spiral galaxy
M104-Virgo, [12.62, -11.4], spiral (Sombrero) galaxy

Note: Objects marked by an * are already plotted as a cross by the STARWARE program. The others are not included in STARWARE. To see the star fields around

each of the other objects use the FINDER program with the Right Ascension and Declination from this table. The object will then be located at the cross in the center of the screen.

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1. Name and APX number of program.

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2. If you have problems using the program, please describe them here.

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3. What do you especially like about this program?

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6. On a scale of 1 to 10, 1 being "poor" and 10 being "excellent", please rate the following aspects of this program:

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_____ User-oriented (e.g., menus, prompts, clear language)
_____ Enjoyable
_____ Self-instructive
_____ Useful (non-game programs)
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7. Describe any technical errors you found in the user instructions (please give page numbers).

_____

_____

_____

8. What did you especially like about the user instructions?

_____

_____

_____

9. What revisions or additions would improve these instructions?

_____

_____

_____

10. On a scale of 1 to 10, 1 representing "poor" and 10 representing "excellent", how would you rate the user instructions and why?

_____

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11. Other comments about the program or user instructions:

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