Chris Marriott's

SkyMap Pro 9

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Introduction

Welcome to SkyMap

SkyMap Pro is a powerful and flexible astronomical companion for your computer, giving you easy access to information which was only available to a select group of professional astronomers a few short years ago. SkyMap combines sophisticated planetarium and map-drawing capabilities with the ability to easily display detailed information on many millions of different objects - stars, planets, galaxies, nebulae, and so on.

At its most basic level SkyMap can act as a simple planetarium, showing you the appearance of the sky, as seen from anywhere on Earth, for any date between 4000 BC and 8000 AD. With a click of the mouse, you can select exactly which features to display - constellation lines, names and boundaries, planets, comets, "deep sky objects", various scale lines and coordinate grids, and much more. You can scroll the map around to show any part of the sky, easily change your geographical location, alter the time and date, and so on. Want to see the appearance of the night sky from Egypt at the time the pyramids were built? A few clicks of the mouse, and it's right there in front of you.

Of rather more practical use to modern astronomers is SkyMap's ability to act as a sophisticated mapping tool; far more flexible and containing hugely more information than the best printed star atlas. You can zoom in to a practically unlimited extent, displaying stars as faint as magnitude 16, and deep sky objects from dozens of different catalogs. Sophisticated "filtering" capabilities allow you to select exactly which objects to display - for example, you might choose to display only globular clusters from the NGC catalog which are brighter than magnitude 10, and larger than 5 arc minutes in diameter. Once you have a map just the way you want it, it can be printed as a high-quality chart on any printer supported by Windows. Full support is provided for printing in both black and white and in colour.

SkyMap's real power comes from the fact that a vast wealth of information lies behind the symbols you see on the map. Click on any object on a map and SkyMap can display all the information available for that object from many different catalogs. The information can be copied to the Windows clipboard, from where it can easily be incorporated into a word processor, or other Windows application. The quantity of information available is huge - for a bright star, for example, it can occupy half a dozen sheets of paper when printed in a small font!

With all those objects available, it's obviously vitally important to be able to quickly and easily locate those objects which interest you, and SkyMap offers powerful search facilities to make that task very simple. The search engine allows you to either draw a map showing the location of an object, or simply to display all the information available about the object.

Although SkyMap is supplied with a large number of different data catalogs, you are not limited to those supplied with the program. An easy-to-use data preparation tool makes it easy to add virtually any data catalog to SkyMap and, once added, those "external" catalogs are fully integrated into the program, allowing the objects they contain to be displayed on a map and searched, exactly as can be done with the "built-in" catalogs. This is an extremely powerful facility for astronomers with specialist interests who wish to use some of the more "obscure" data catalogs which are available.

Another facility offered by SkyMap is the ability to associate images with objects in the SkyMap database. Click on any object on a map and SkyMap will search for a picture of that object, giving the option to display it if found. SkyMap can be used with almost any picture viewing program, and can support any image format which that viewer can handle. SkyMap is supplied with a large collection of astronomical pictures, generously contributed by amateur astronomers, and it's very easy to add your own pictures too. SkyMap isn't supplied with a picture viewer - you can either use the simple viewers supplied with Windows, or more "sophisticated" picture viewing programs available from many third parties.

There are a number of planetarium programs available today. Unlike some of these, SkyMap makes no claims of blindingly fast calculation speeds. Instead, what SkyMap concentrates on is *accuracy*, always making use of the most up-to-date data and the most accurate calculation methods available. This accuracy makes SkyMap equally suited for both the novice astronomer who just wants to know "what's that bright object up there?" and the serious amateur or professional astronomer who wants a detailed "finder chart" for a faint galaxy. SkyMap carries out its calculations in as efficient as manner as possible, but it *never* compromises accuracy for the sake of speed. An increase in speed can always be achieved by using a faster computer!

Now that you own a copy of SkyMap, you'll want to keep up-to-date with our web site at http://www.skymap.com. Here you'll find a huge amount of information for SkyMap users - a library of data catalogs, the latest orbital elements for comets and asteroids, a "chat area" in which you can talk to either us, or other SkyMap users, and lots more. Come and visit us soon!

Finally, if you have any suggestions for ways in which this program could be improved, feel free to either leave a message on our web site, or send e-mail to "support@skymap.com".

Installing SkyMap

Before installing SkyMap, please ensure that you exit all other applications running on your computer. If other programs are running, the SkyMap installation program may be unable to install "system" files that it needs to install.

To install SkyMap, simply place the CD-ROM into the CD drive of your computer. After a brief delay, the CD should "auto play", and the installation program will run. If it doesn't auto play (you might have switched auto play off for your CD drive), use the Windows Explorer to locate the file "setup.exe" in the root of the CD, and run this program to start the installer.

When the installation program starts running, the first screen you'll see is a "Welcome" screen, as shown below:
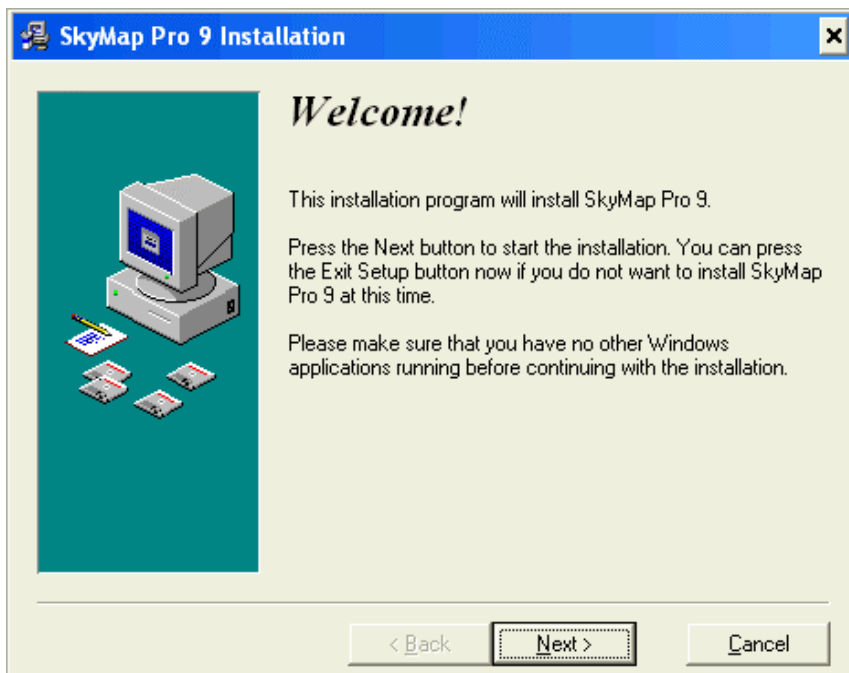
Click the "Next" button to continue., and you'll see a screen showing the program's licence agreement, as shown below:
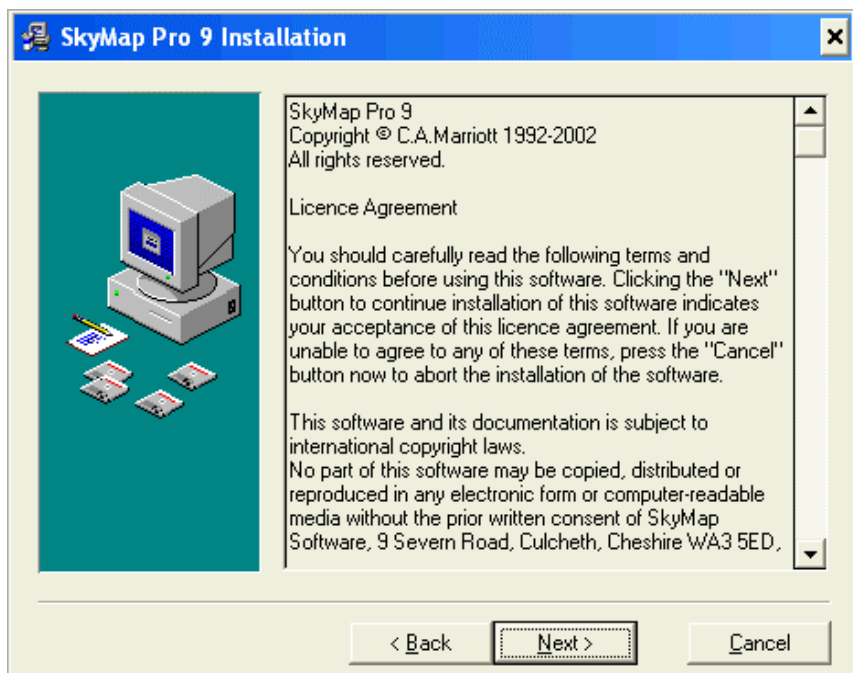
Please do read this – it is important! If it contains anything that you are unable to agree to, please cancel the installation of the program, and return it to one of our publishers for a full refund.

Click the "Next" button to continue, and a screen will be displayed asking you to select the name of the directory into which SkyMap should be installed:

Please select the directory where the SkyMap Pro 9 files are to be installed.

C:\Program Files\SkyMap Pro 9   Browse
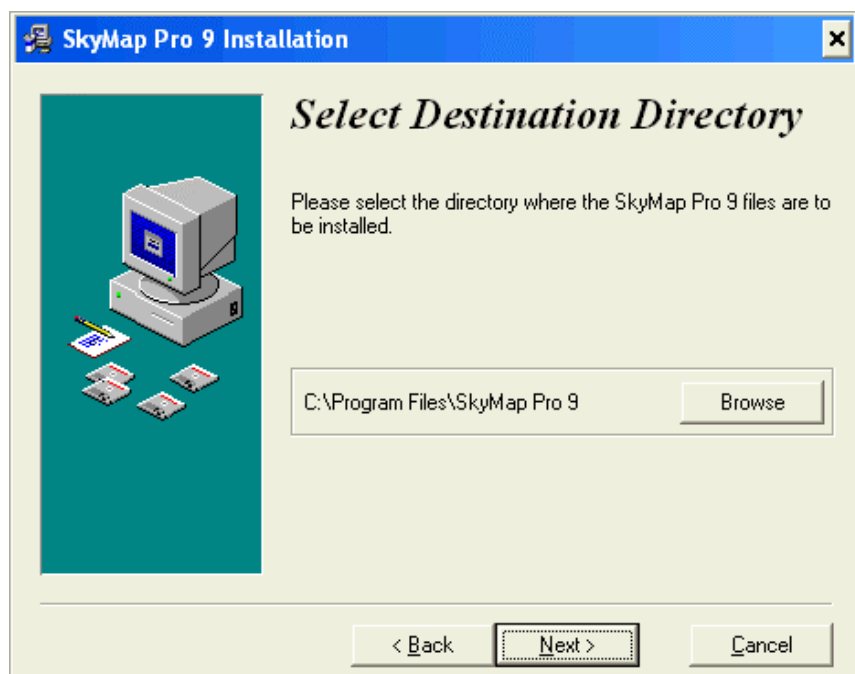
If you wish to install into the default directory offered, nothing need be changed. If you wish to use a different directory, click the "Browse" button and select the desired directory.

Click the "Next" button to continue, and the next screen will be displayed, asking you if you wish to back up replaced files:
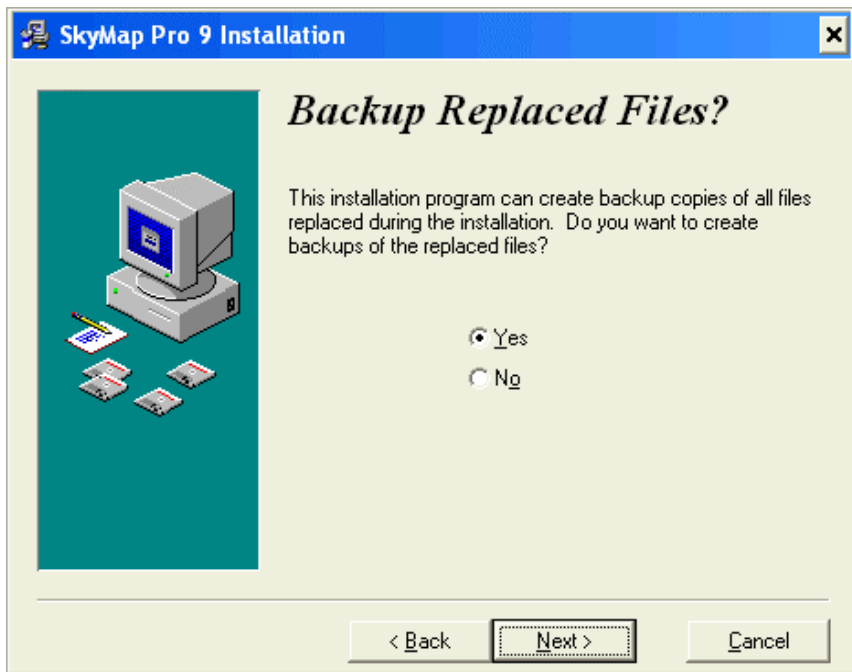
The installer sometimes needs to replace existing files on your computer, and this option asks whether or not the original versions of those files should be saved, allowing the originals to be replaced if you uninstall the program. Unless you have a specific reason not to do so, you should leave this dialog set to its default answer of "Yes".

Click the "Next" button to continue. Assuming that you've answered "Yes" to the previous question, the next screen to appear will ask for the directory in which backed-up files should be stored:

SkyMap Pro 9 Installation

Select Backup Directory

Please select the directory where the replaced files will be copied.

C:\Program Files\SkyMap Pro 9\BACKUP   Browse

< Back   Next >   Cancel
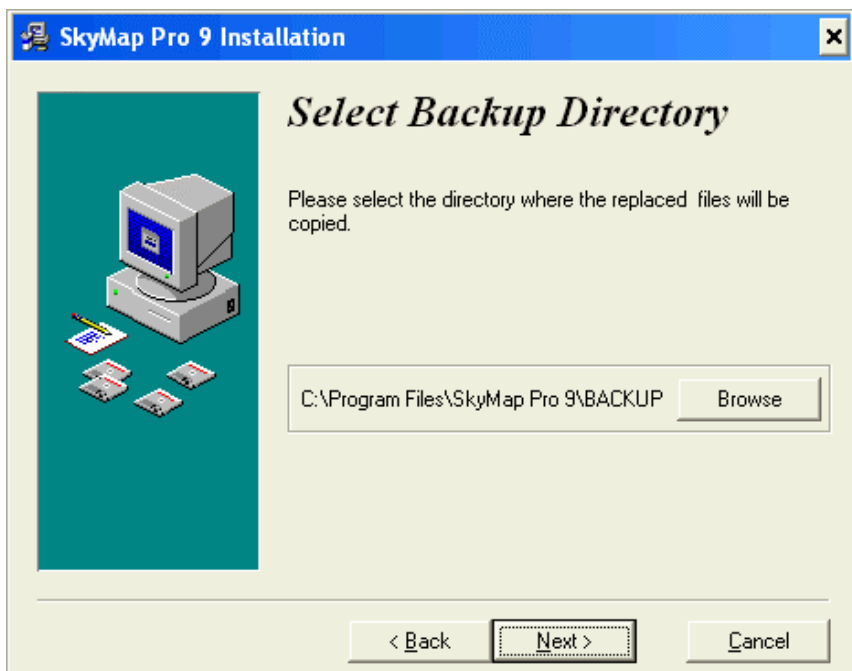
The default location will be a "Backup" subdirectory of the SkyMap installation directory, and you should normally accept this location. If you wish to change it, click the "Browse" button to select the name of the directory to be used.

Click the "Next" button to continue, and the "Installation Options" screen will be displayed:

SkyMap Pro 9 Installation Options

Installation Options

Please selection the type of installation required. A complete installation will copy all files to hard disk, and SkyMap can then be run without the CD-ROM. A standard installation will copy the most important files to hard disk, and will require the SkyMap Pro CD-ROM to be in the drive to access other catalogs. A minimum installation will run entirely from CD-ROM.

○ Complete installation (533MB disk space)

● Standard installation (186MB disk space)

○ Minimum installation (17MB disk space)

Disk Space Remaining:	28639164 k

< Back | Next > | Cancel

This screen allows you to select the way that SkyMap is installed, and is extremely important. There are three options:

Complete installation

Selecting this option will install the whole of SkyMap to your hard disk, and will use approximately 540MB of disk space. If you have the required amount of disk space free, you should select this option; it will result in SkyMap running at its maximum speed, and (perhaps more importantly) you will be able to run SkyMap without having to put the CD in the drive every time the program is run.

Standard installation

Selecting this option will install the basic star and deep sky object catalogs to your hard disk, and will use about 190MB of hard disk space. If you select this option, you can run SkyMap either with or without the SkyMap CD-ROM in the drive, but running it without the CD will restrict you to only seeing the "basic" catalogs on the star charts. If you run the program with the CD-ROM in the drive, all the catalogs will be available. This option corresponds to the method used to install previous versions of SkyMap.
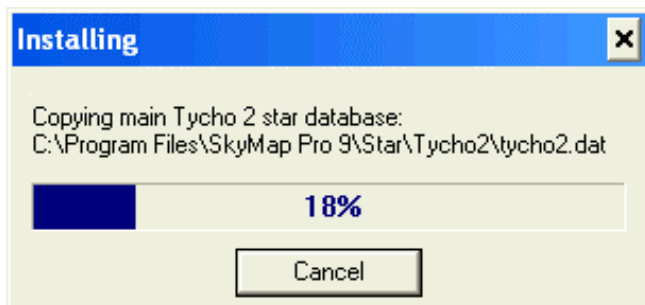
Minimum installation

This option is provided for users who are extremely short of space on their hard disk. It uses only 17MB of hard disk space, and installs only the bare minimum of files to hard disk. If you select this installation option you **must** have the SkyMap CD-ROM in the drive in order to run the program (it will crash if you attempt to run without the CD!), and the program will run *extremely* slowly, due to the fact that a CD drive is much slower than a hard disk. Only select this installation option if you really must do so!

After selecting the desired installation option, click the "Next" button. All the required information has now been entered, and the next screen to be displayed will be the "Ready to Install" screen, as shown below:
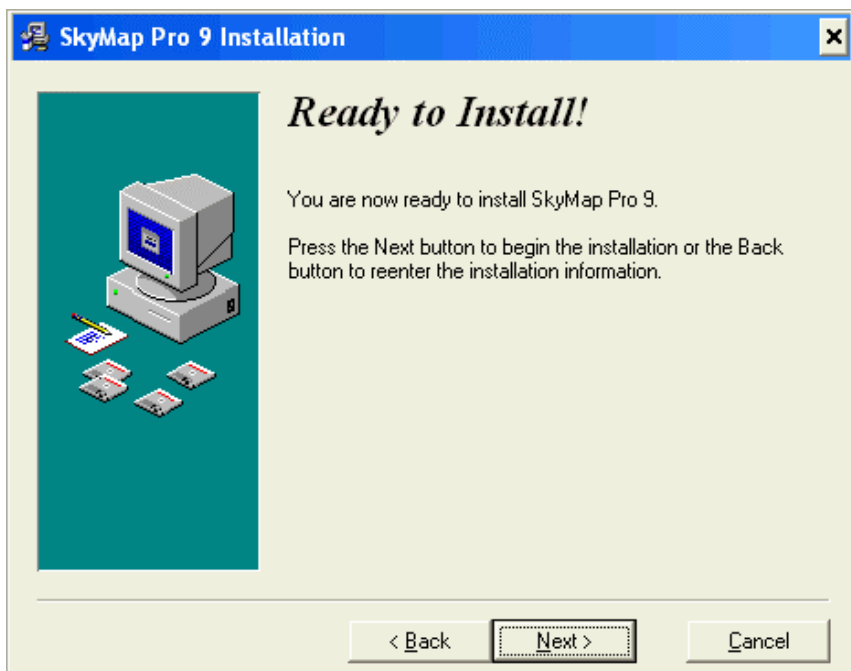
At this point you may, if you wish to do so, click the "Back" button to move backwards through the previous screens and make any changes that you wish to do so. Once you are certain that all the information has been entered correctly, click the "Next" button, and the installation will begin, with the progress of the installation being shown by a bar which expands from left to right:

One "peculiarity" of the installation program is that the indicated progress will only go as far as 100% if you have selected the "Complete" installation option; if you've select the "Standard" or "Minimum" installation options, installation will finish before the progress bar reaches 100%. This is the expected behavior and is not an error.

When all the required files have been copied, a box will appear asking whether or not you wish to add a "SkyMap" icon to the Windows desktop:
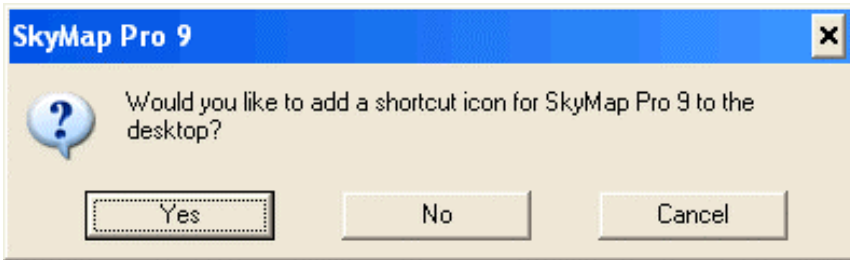
A desktop icon provides a convenient way of running the program, and we recommend clicking the "Yes" button. If you do not want an icon on the desktop, click the "No" button.

The final screen to appear is the "Installation Completed" screen, shown below:

SkyMap Pro 9 Installation

Installation Completed!

SkyMap Pro 9 has been successfully installed.

Press the Finish button to exit this installation. Please reboot your computer before running SkyMap Pro 9 for the first time.

SkyMap Pro 9 has an "observing log" facility allowing you to record your observations; this uses a database which must be separately installed before the observing log can be used. Please refer to the "Using the Observing Log" chapter of the manual or online help system for information on installing the database.

< Back   Finish   Cancel

Installation has now been successfully completed. Click the "Finish" button to exit the installer and return to Windows.

Please note that before running SkyMap for the first time, you must install the database support files. This process is described in the next section of the manual.

Running SkyMap

Before running SkyMap, make sure that the SkyMap CD-ROM is in your CD drive (if you selected the "complete" installation option, it is not necessary to do this; the program will run without the CD-ROM being present).

To run SkyMap, either one of the following methods can be used:

Double click the "SkyMap Pro 9" icon on the desktop.

Click the "Start" menu, and then select in turn, "Programs", "SkyMap Pro 9", "SkyMap Pro 9".

The SkyMap window will appear, initially blank. After a few seconds (depending on the speed of your computer), a map window will appear, together with a "Tip of the Day" dialog, giving a helpful hint about using the program. Click the **OK** button to dismiss this dialog. SkyMap is now ready for use.

How to use the help system

The on-line help system is SkyMap's primary source of documentation. The following hints may prove useful in learning to get the most from the help system:

Displaying the table of contents

To show the table of contents for the help system, run SkyMap, click the **Help** menu title, and select the **SkyMap Pro Help Topics** item from the menu.

Learning to use the program

To learn the basics of using SkyMap, read the pages in the contents list in sequence, like a book. These pages give general information about what SkyMap can do, and how to do it. They do not describe each menu item or dialog box in detail - that is left to the "context sensitive" aspects of the help system.

Obtaining help with a menu or tool button

As you move the mouse pointer over a menu item or toolbar button, a brief (one line) description of that item or button appears at the left side of the status bar at the bottom of the SkyMap window.

Obtaining help on a dialog box

To get help on the operation of a dialog box, press the **F1** function key whilst the dialog is visible on the screen. In some cases this will give a full description of the dialog immediately, whilst in other cases (mainly for the more complex dialogs), a brief description will be given with a "More" button at the bottom of the text. Click the "More" button to display the complete help information for that dialog.

Understanding astronomical terms

If you're new to astronomy and you come across something in this manual which you don't understand, you may find the information in the appendix to the help system to be of use. The appendix contains a number of different tables, including information about the meaning of astronomical terms, the names of all the constellations, and the Greek alphabet.

Tutorial

Tutorial Lesson 1 - Introduction

This tutorial gives a brief "hands-on" introduction to some of the main features of SkyMap Pro. To get the most from it, we strongly encourage you to "follow along" the instructions with the actual program. All the facilities introduced here are described in much greater detail later on in the help system; this tutorial's main purpose is to allow you to get a feel for what you can do with the program.

Running SkyMap

If SkyMap isn't already running as you read this, make sure that the SkyMap Pro CD-ROM is in your CD drive (unless you've done a "complete" installation, in which case you don't need to do this), and then run it by either double-clicking the "SkyMap Pro 9" icon on the Windows desktop, or by going to the **Start** menu on the Windows task bar, and selecting the **Programs/SkyMap Pro 9/SkyMap Pro 9** menu item. The SkyMap window will appear, and a few seconds later (depending on the speed of your computer), the initial SkyMap chart will be shown looking something like this:
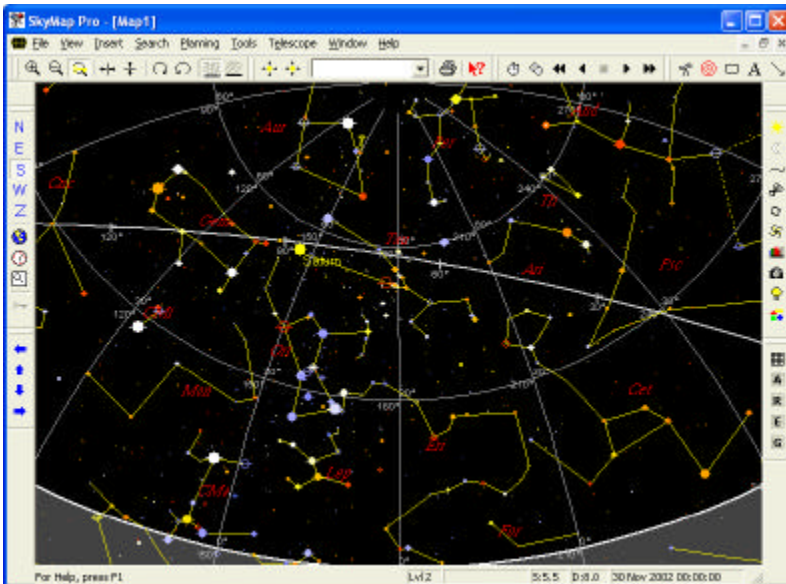
Understanding the SkyMap screen

The exact appearance on the map will depend on the time of day and the date that you run SkyMap, but the map which appears on the screen will look *something* like that shown above. The map shows the view looking southwards (initially from north west England) at whatever the current time and date happens to be.

The most prominent feature of the map are the circles which represent the stars - the larger the circle, the brighter the star. Notice that some circles have short horizontal lines through them - these represent double stars, whilst others are drawn with hollow circles - these are variable stars. A few stars are both double *and* variable; these are, as you might expect, shown as hollow circles with a line through them. If it's currently daytime, the stars will be shown as white circles, but if (as is the case with the picture above) it's nighttime, the stars will be displayed in roughly their true colours.

Many stars on the map are connected by lines. These lines form "stick figure" representations of the constellations - the 88 "regions" into which the sky is divided. Although the *area* of each constellation is precisely defined, the sole purpose of the "stick figures" is to aid in visually identifying the constellations, and the figures have absolutely no "official" status - if you've got other astronomy books or programs, you may very well have seen different figures used to represent the constellation shapes.

Depending on the time and date - the Sun, Moon or planets may be visible on the map. On the map shown above, Saturn is visible just to the left of the map centre. Had the Moon been visible and this time, it would have been displayed on the map with the correct phase and "angle in the sky.

The "grid" of curved and straight lines on the map are lines of constant azimuth (compass bearing) and altitude (height above or below the horizon) and show the direction in which the objects on the map are currently to be seen. The thick curved line along the bottom of the map is the horizon - everything above this line is visible in the sky, whilst everything in the shaded area below it is invisible. The curved lines running roughly parallel to the horizon are lines of constant altitude - all objects on these lines are the same distance above the horizon; the label at the upper right of every grid "intersection" shows the altitude. The lines running more or less "down" the map are lines of constant azimuth (compass bearing); the line down the centre of the map represents 180° azimuth, or due south; each line to the left and right is 30° further east or west respectively as shown by the label at the lower left of each grid intersection. The point directly overhead - the "zenith" - is the point where all the lines of azimuth converge, at the centre of the top edge of the map. The thick line which passes just above Jupiter and Saturn is the ecliptic - the apparent path followed by the

Sun against the stars over the course of a year; the planets will always lie close to this line.

The "buttons" along the left, top, and right sides of the window form the main means of controlling SkyMap. Look at the strip of buttons down the left side and you'll notice that the "S" button is shown "pressed in"; this indicates that the map is currently showing a standard view of the southern horizon.
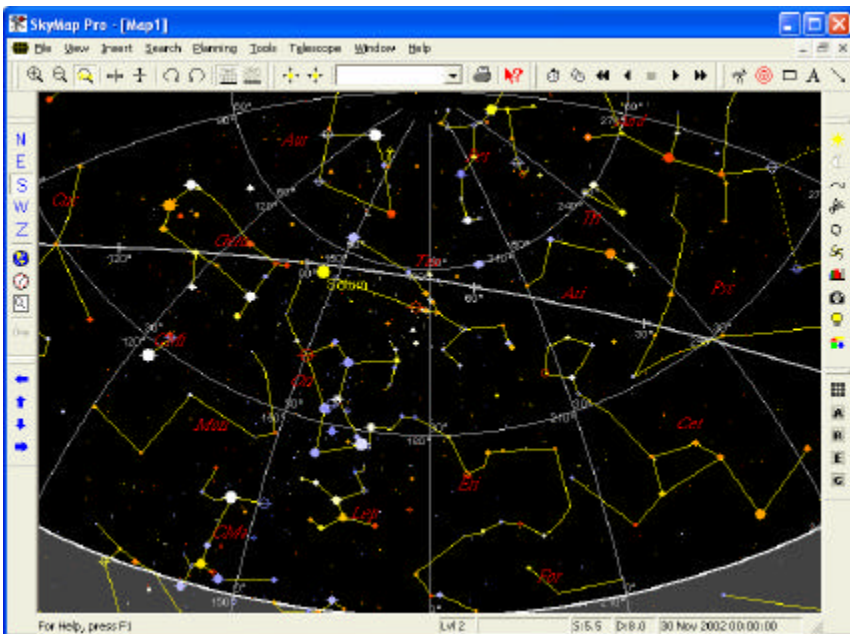
Finally, along the very bottom of the map window is a "status bar" displaying current information about the map. Two items of particular interest are "S 5.5" - indicating that the faintest star currently visible on the map is magnitude 5.5 - and the panel to the right of that which shows the date and time for which the map has been drawn (midnight on 30th November 2002).

Tutorial Lesson 2 - Moving the map around the sky

Lesson 1 discussed how to run SkyMap, and explained the meaning of the various parts of the map window. Now that we understand what we're looking at, it's time to be adventurous and learn how to look at different parts of the sky!

Displaying the standard map views

Run SkyMap as discussed in lesson 1, so the initial view of the southern horizon is displayed:

Look at the strip of toolbar buttons running down the left side of the window; the buttons labelled **N E S W Z**. At the moment, the **S** button is pressed in, indicating that a standard view of the southern horizon is currently visible.

 Click the **N** button; the map will change to show a view of the northern horizon:

 Notice that the **N** button is now "pressed in" on the left toolbar, showing that the northern horizon is now visible. Looking at the map shown above, notice that the "pole star" is shown at the end of the tail of the "Little Dipper", just above the centre of the map and almost exactly on the 0° azimuth line, or due north. To the right of the map is the "Big Dipper" or "Plough", standing vertically on its "handle". The two stars at the end of the Big Dipper are called the "pointers", and point directly at the pole star. Above and to the left of the pole star can be seen the upside-down "W" (looking more like an "M" here!) of the very prominent constellation of Cassiopeia.

 Click the **E** and **W** buttons to see a view of the eastern and western horizon in exactly the same way, and then click **S** to return to the initial view of the southern horizon.

Alternatively, you can press the **N**, **E**, **S**, and **W** keys on the keyboard as a "shortcut" for clicking the toolbar buttons.

The final button on that toolbar - the button labelled **Z** does something rather different. Click the button (or press the **Z** key on the keyboard and see what happens:
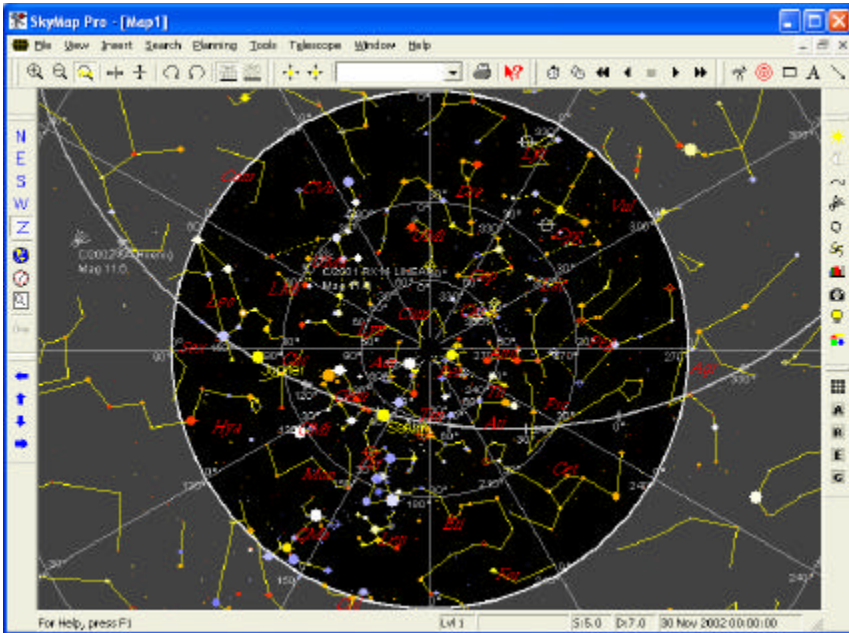
What the **Z** button does is change the map so it displays the entire visible sky. The thick circle represents the horizon, with north at the top, east on the left, south at the bottom, and west at the right. The centre of the map is the "zenith" - the point directly above your head (hence the **Z** marking on this button!). This map provides a very quick method of displaying an overall view of the entire sky, so you can see which constellations are currently visible in the different parts of the sky. Note the thick line of the ecliptic crossing the sky from east, through south, to west.

Finally, press the **S** key to return to the initial southern horizon view.

Moving the map left and right

As we've seen, the **N E S W Z** toolbar buttons provide an easy way of displaying five "standard" views of the sky, but very often you'll want to look at a different part of the sky, perhaps to display a particular constellation in the centre of the map.

If it's not already there, press the **S** button to return to the standard southern horizon view, and then click the [←] button on the toolbar at the left side of the screen, each time waiting for the map to redraw. Each time you click the button (or press the left arrow key on the keyboard), the map moves to the right, and "new" parts of the map become visible on the left. Pressing the left arrow key is like turning your head to the left to look at a part of the map you can't currently see looking straight ahead.

After you've scrolled left three times, the original map will look rather like this:
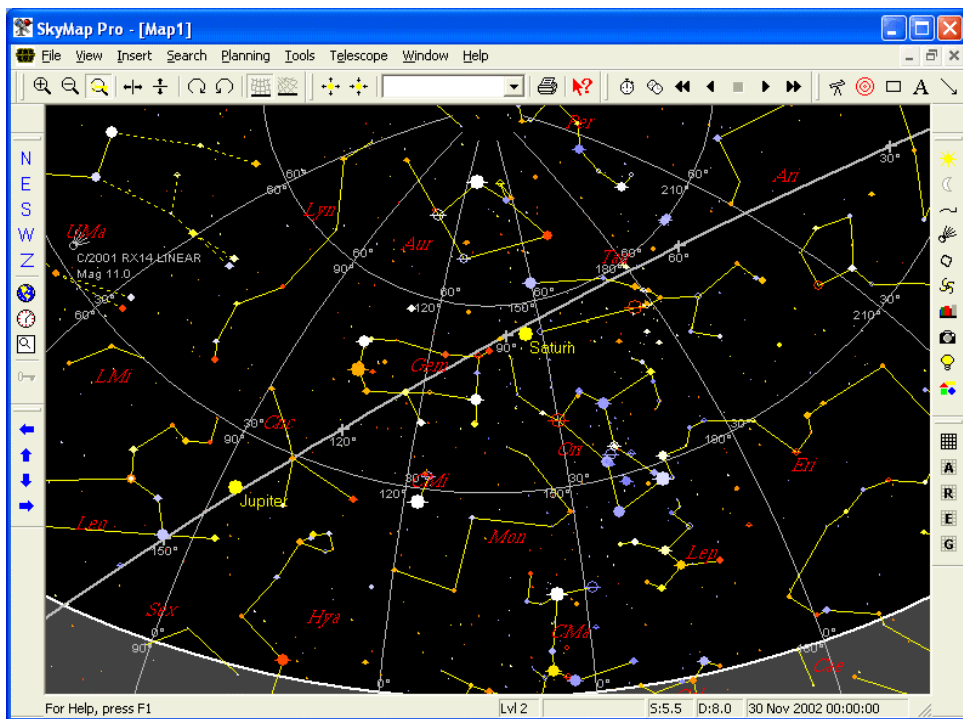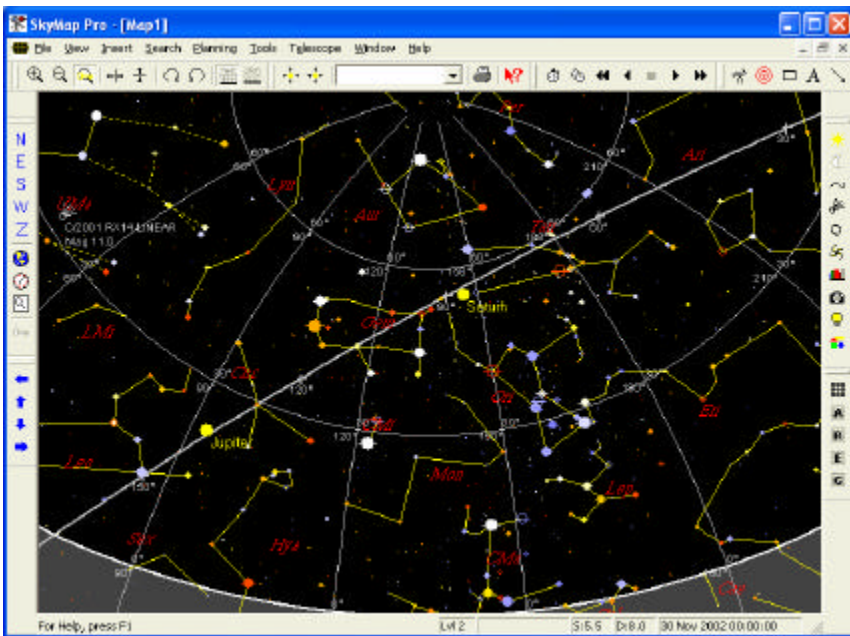
The original map "centre" of due south is now way off to the right of the map (the line labelled 180°), whilst the eastern horizon (the line labelled 90°) is visible at the left side of the map. Notice that the middle of the map is between the lines labelled 120° and 150°, which means that the centre of map is showing what we'd see if we were to looking in a south-easterly direction (SE is azimuth 135°).

Carry on pressing the left arrow key (hold it down if you wish), and the view will continue to move eastwards, showing in turn the east, north, west and then once again the south view. After you've pressed the left arrow button a total of 24 times, the map will have turned "full circle", and will once again be showing the original southern horizon view. Remember that you can get back to any of the "standard" views at any time by clicking the buttons on the toolbar on the left side of the window.

Next, try pressing the *right* arrow key on the keyboard (or clicking the ➡ toolbar button). This time (as I'm sure you've already guessed) the map will move to the *left*, showing new parts of the sky at the right side of the map. Pressing the right arrow key is like turning your head to the right; each time you press the key, the centre of the map moves westwards. Hold down the right arrow key, and the map will continually

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move to the west, bringing you back to your original starting point after 24 presses of the key.

Moving the map up and down

So far, all we've done is to move the map left and right; in all the maps we've drawn (except the "whole sky" zenith map), the horizon has been drawn along the bottom of the map, with the zenith at the mid-point of the top edge of the map. There are many situations where we want to move the map up or down; when we do this, the horizon and zenith are no longer at the bottom and top of the map respectively. Moving the map up or down is equivalent to raising or lowering your head to look further up or down in the sky.

Press the **S** button to return to our standard starting point of the southern horizon view, and then press the down arrow key three times (or click the ⬇ button), waiting for the map to be redrawn after each key press. Each time you press the down arrow key, the horizon line on the map will move up, until after three presses it runs across the middle of the map:
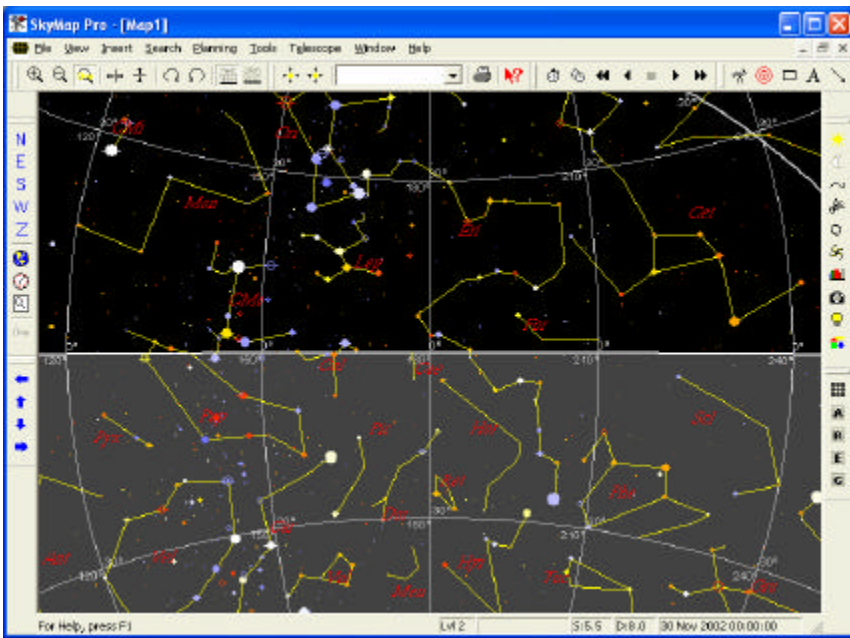
The thick line still represents the horizon, but the map is now showing us half the sky *below* the horizon; the upper half of the map shows the visible sky, and the shaded lower half of the map shows sky which is *not* visible to us.

Click the **S** button to return to our standard starting point, and this time press the up arrow key (or click the button) three times. Each time you press up arrow, the zenith (which was originally at the top of the map) will move down the map, until after three key presses it'll be in the centre of the map:
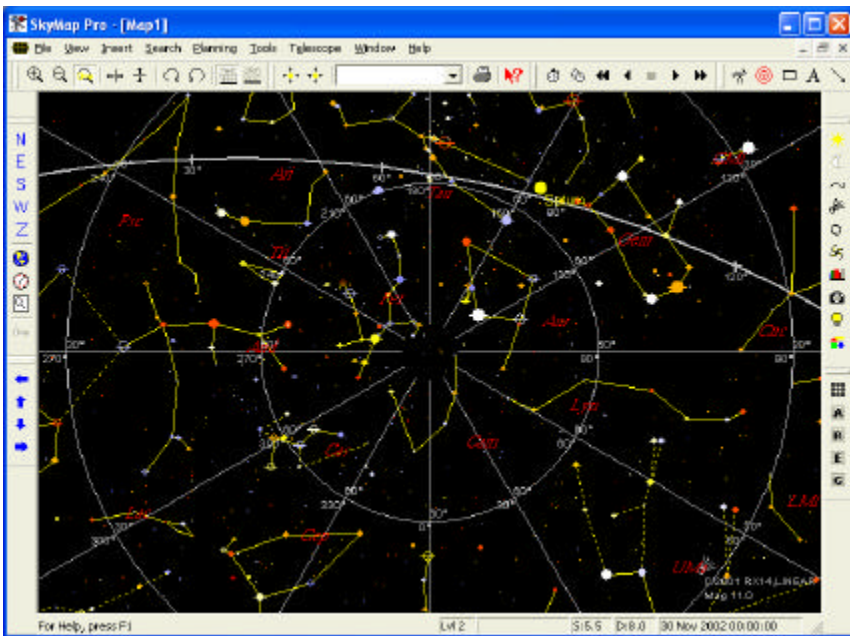
The point directly overhead (the zenith) is now in the centre of the map - this is the point at which all the azimuth lines converge. The map is now showing us the region of the sky directly overhead, with the lines of constant altitude appearing as circles on the map, and lines of constant azimuth as "spokes" radiating from the zenith. Notice that we can no longer see the horizon at all on the map!

Summary

You now know how to move the map around to view any part of the sky. Practice using the arrow keys on the keyboard to move the map's viewpoint around the sky; you'll very quickly be able to look at any area of the sky that you wish. Remember - left and right arrow change the *azimuth* or *compass bearing* of the map centre; up and down arrow change the *altitude*, or *height above or below the horizon*, of the map centre. No matter which part of the sky you're looking at, you can return to one of the five "standard" views by clicking the **N E S W Z** toolbar buttons, or by pressing the N, E, S, W or Z keys on the keyboard..

In the next lesson, we'll learn how to change the date and time, and the location for which the map is drawn.

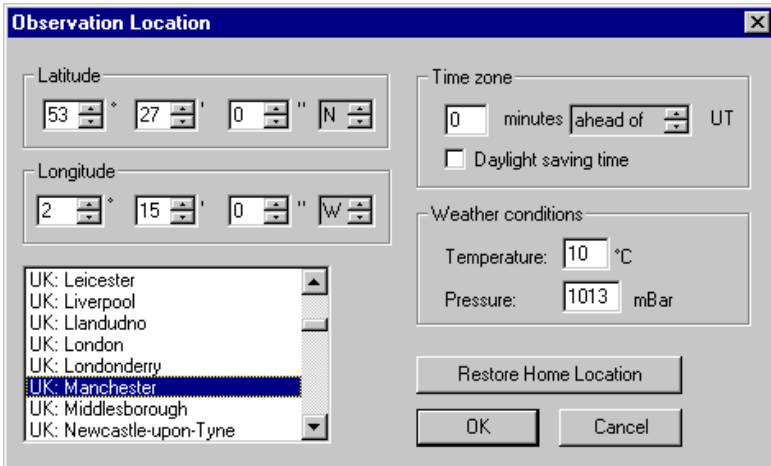# Tutorial Lesson 3 - Changing the time, date, and location

If it's not already running, start SkyMap and switch to the standard southern horizon view as we've learned in previous lessons.

Changing the viewing location

In order to display an accurate picture of the sky, SkyMap needs to know your geographical location - the sky looks completely different as seen from England compared to its appearance from Australia!

When SkyMap is first installed, it will always display the sky as seen from northwest England, which just happens to be the home of the author of the program. That's fine for me, the author, but you, the reader, very likely *don't* live in that part of the world, and will want to see the sky as it looks from where *you* live.

To set the location, go to the toolbar on the left side of the window, and click the button with the picture of the Earth on - the [globe icon] button. SkyMap will display the "Observation location dialog", which looks like this:

In order to correctly display the sky, SkyMap needs to know three pieces of information:

Your latitude - how far north or south of the equator you live.

Your longitude - how far east or west of the "Greenwich Meridian" you live.

Your time zone - how far ahead of or behind UT (GMT) your clocks are.

If you don't know your latitude and longitude, go to your local library and look at a map of your area. Great accuracy is not required - a position accurate to the nearest degree is sufficiently accurate for nearly all purposes.

To set up the information, you can either select a place name from the list in the lower left part of the dialog, or you can manually enter your latitude, longitude, and time zone in the appropriate fields of the dialog. As with all dialog boxes in SkyMap, if you need help while filling it in, just press the **F1** key on the keyboard, and a help screen will be displayed explaining in detail the meaning of every field on the dialog.

For the purposes of this tutorial, let us suppose that you live in Miami, Florida. Using the scroll bars, scroll through the list of place names to reach the country name "USA", and then scroll through the list of place names in the USA (which are arranged in order of state name) until you find "USA:FL:Miami". Click on this name in the list, and the dialog fields will be filled in with the latitude, longitude, and time zone for Miami:

Notice that the time zone information is entered in *minutes*. The state of Florida uses Eastern Standard Time (EST), which is 5 hours behind GMT, so the time zone is entered as 5 x 60 = 300 minutes behind GMT (or "UT", as SkyMap calls it).

Finally, if you're currently using "daylight saving time" or "summer time", click the mouse in the "Daylight saving time" box so a "check mark" appears there. If you're not currently using DST, leave this box blank.

When all the information has been entered correctly, click the **OK** button. The dialog box will disappear, and the map will be redrawn to display the sky as seen from Miami, Florida:

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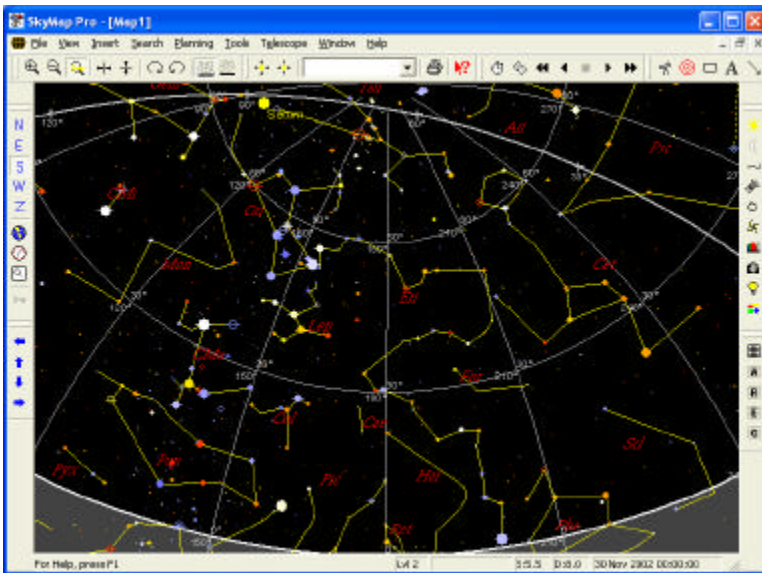
If you compare this map with the ones shown in the previous lesson, you'll see that Orion is now much higher up in the sky, and the bright star "Achernar" (which can never be seen from England) is visible just above the horizon to the right of the map centre, at about azimuth 190°.

Experiment with other locations. If you live in the northern hemisphere, try setting the location to somewhere like Australia to see what the sky looks like from the southern hemisphere - notice how all the familiar constellations are "upside down"! Of course, if you live in the southern hemisphere, do the opposite!

Saving the default "home position"

We've now learned how to change the geographical location for which SkyMap displays the sky, but it would be (to put it mildly) a bit of a nuisance to have to *manually* change the location every time we run SkyMap. Fortunately, we don't have to do this; SkyMap lets us save any position we want as our "home position" and will then use that home position as the default whenever the program is run again.

To store the home position, first display the observation dialog and enter the position, as we've described previously. Make sure that the map is showing the default southern

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horizon view, and then go to the **File** menu at the top of the SkyMap window, and choose the **Save Defaults...** menu item. SkyMap will display a message, asking you to confirm that the current program settings should be stored as the defaults:
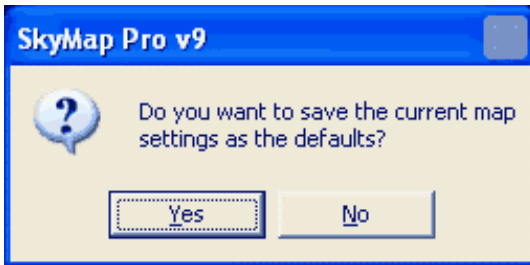
Click the **Yes** button. SkyMap will store all the current map settings as the defaults to be used whenever the program is run in the future.

Changing the time and date

When SkyMap is run, it reads the time and date from the computer's clock, and displays a map showing the sky as it looks at that time. That's fine if you want to see what the sky looks like "now", but you'll very often want to draw a map showing the sky at is appears for a different time or date.

To change the time or date, go to the toolbar at the left side of the screen, and click the button. SkyMap will display the "Observation time dialog":
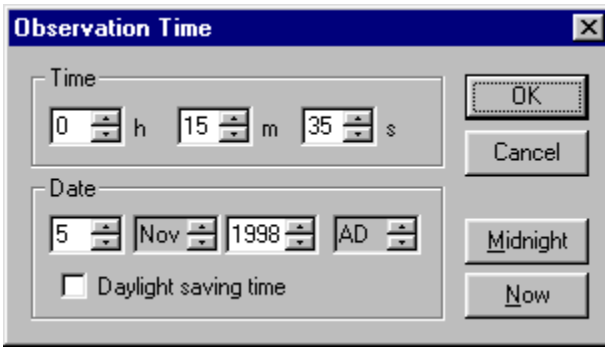
Use the dialog fields to set the time and date to whatever you wish, and then click the **OK** button to redraw the map for the new time and date. The dialog provides a couple of useful "shortcut" buttons; clicking the **Now** button will set the time and date to the current time read from the computer's clock, while clicking the **Midnight** button will leave the date unchanged, but change the time to 00h 00m 00s. If the date for which you want to draw the map has daylight saving time (summer time) in operation, check the "Daylight saving time" box; if the date doesn't have DST in operation, make sure the box is blank. Note that SkyMap always operates using the "24 hour clock", so 6pm is 18h, 10pm is 22h, and so on.

Practice changing the time and date to different values and see what effect this has on the map.

Summary

In this lesson we've learned how to display a map showing the sky as seen from anywhere on Earth, for any time and date. We've also learned how to set the default position which SkyMap uses when it's first run.

In the next lesson we'll learn how to "zoom in" and take a more detailed look at small parts of the sky.

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Tutorial Lesson 4 - Changing the map's field of view

In previous lessons we've learned how to set the time and location for which the map is drawn, but we've always used the "default" map view. In this lesson we'll learn how to change the map's field of view to take a "close-up" look at small parts of the sky.

A map's "field of view" refers to the "amount" of sky visible from the top to the bottom of the map, measured in degrees. The distance from the horizon to the zenith (the point directly overhead) is 90°; the "height" of your clenched fist with your arm stretched out is roughly 5°; the diameter of the Moon is about half a degree, or 30 arc minutes (a degree is divided into 60 minutes, a minute is divided into 60 seconds; $1° = 60' = 3600"$).

The "standard" views we've been working with so far - those displayed by the **N E S W** buttons - all have a field of view of 90°; the horizon is at the bottom of the map and the zenith at the top. The "whole sky" map, displayed by the **Z** button, has a field of view of 180° (the maximum field of view which SkyMap will display).

The five standard views are ideal for getting an overall view of which constellations are currently visible in different parts of the sky, but very often we'll find to take a much more "in-depth" look at a small area of the sky. This will let us see much fainter stars, as well as other objects such as galaxies, nebulae, star clusters, and so on. This lesson describes a number of methods for changing the field of view of the map.

View levels

A vital concept to understand when using SkyMap is the idea of "view levels", or simply "levels" for short. View levels are a set of ten pre-defined fields of view with level 1 being the widest possible field of view (180°), and level 10 the narrowest (similar to a view through a very high-power telescope eyepiece). The higher the view level, the fainter the objects which will be shown on the map. Virtually every SkyMap feature is defined in terms of a range of view levels - for example, constellation "stick figures" are, by default, switched on between levels 1 and 5 and switched off between levels 6 and 10; SkyMap's main "galaxy catalog" is only switched on between levels 5 and 10, and so on. Whenever the map's field of view changes, SkyMap finds which view level the new field of view is closest to, and adjusts all the map settings to match that level.

The current view level is always visible in one of the panes on the status bar at the bottom of the SkyMap window:

| Lvl 2 |

Selecting view levels directly

The easiest way of changing the map's field of view is to directly select one of the ten view levels by pressing one of the number keys on the top row of the keyboard. Press 1 to select level 1, 2 for level 2, and so on, up to 0 for level 10.

Let's try doing that now. Start off by pressing the **S** button to display the standard southern horizon view. Look at the status bar and notice that it says "Lvl 2" - the standard north, east, south, and west horizon views correspond to view level 2. Notice also that the magnitude pane of the status bar says "S 5.5", telling us that the faintest star currently visible on the map is magnitude 5.5, corresponding to stars visible in relatively dark skies with the naked eye.

Now press the "3" key on the top row of the keyboard. The mouse pointer will change to an "hourglass" for a few seconds while the new map is computed, and then a "zoomed in" view of the map will be displayed, looking something like this:
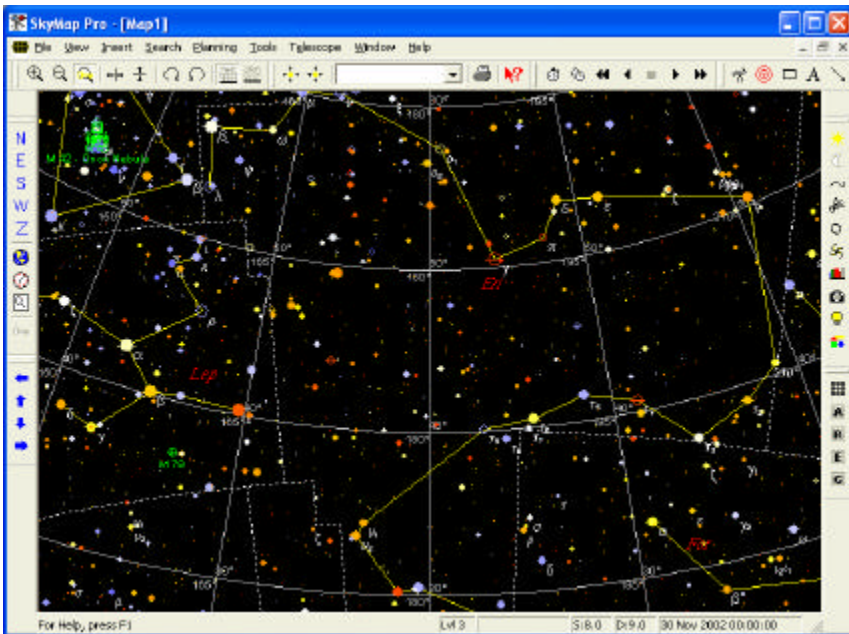
What's happened here is that the position of the map *centre* has stayed the same, but the field of view is now slightly over 30°, compared with the 90° of the original map - ie we're looking in greater detail at an area of the sky 9x smaller than that shown on the original map. There are several new things to notice about this map:

Look at the labels at the intersection of the altitude/azimuth grid lines and note that the altitude lines are now spaced 10° apart, compared with the 30° of the original map. When we change the field of view of the map, SkyMap decides automatically the best way to draw the coordinate grid and since we're looking at a much smaller area of the sky here, it's drawn a more "finely spaced" grid allowing us to measure positions more accurately.

Look at the status bar, and notice that it's now telling us that we're at level 3, and that the limiting magnitude of the stars is 8.0. We're now seeing much fainter stars on the map - roughly equivalent to what would be seen through a small pair of binoculars.

The bright stars on the map are now labelled with Greek letters - these are called "Bayer letters", and are the standard way of referring to the brightest stars in each constellation. Bayer letters are switched on, by default, whenever the current view level is 3 or greater.

The map now shows dotted lines marking the official "boundaries" between the constellations. These boundaries, unlike the constellation "stick figures", are "official" and precisely define which part of the sky is occupied by each constellation; every point in the sky is in exactly one constellation.

You may see some "deep sky objects" appear on the map.

Try using the arrow keys on the keyboard to move the map around the sky. You'll find that it moves left, right, up, or down exactly as with the original map. Pressing "up arrow", for example, will still move the viewpoint up by 1/3 the map's height; the only difference of course is that now that movement corresponds to a much smaller distance in the sky since the map has a smaller field of view.

Let's "zoom in" again. Press the "4" key on the keyboard; once again the mouse will briefly (or not, depending on the speed of your computer!) turn to an hour-glass, and then the new map will be displayed looking something like the picture below:
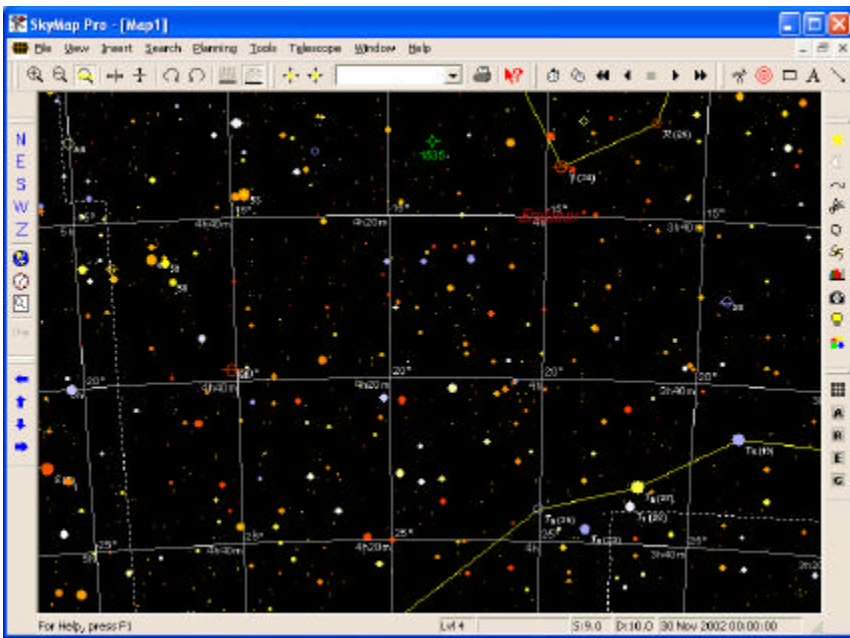
This time something rather different has happened - we've now got a completely different coordinate grid, marked in "right ascension" and "declination" rather than the azimuth and altitude coordinates we had before. Previously we were looking at a comparatively large area of the sky, and SkyMap was showing us "horizon coordinates" - a coordinate grid based on which direction objects are in as seen from the observer's location. We're now looking at a small part of the sky, and it's more convenient to work in "equatorial coordinates" - right ascension and declination. Unlike alt/az coordinates, which are constantly changing as an object rises in the easy, moves across the sky, and sets in the west, RA/dec coordinates don't change as the earth rotates - they form a "fixed" coordinate grid on which stars, galaxies, and so on, are at fixed positions (to a good approximation). All printed star atlases use RA/dec coordinates. Any introductory book on astronomy explains this is much more detail than we've done here. By default, SkyMap will display an RA/dec coordinate grid whenever the view level is at or above level 4.

A few other things to notice about this map:

The status bar shows we're now at level 4, and that the map is now displaying stars as faint as magnitude 9.0.

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Note that several stars on the map are now labelled with numbers. These are called "Flamsteed numbers", and are the conventional way of referring to the brighter stars in each constellation which don't have Bayer letters. SkyMap, by default, displays Flamsteed numbers at level 4 and above.

We've now got "deep sky objects" visible on the map - the "circle with spikes" labelled "1535" in the upper centre of the map is the planetary nebula "NGC 1535" (all deep sky objects without a "prefix" are objects in the "NGC" catalog).

Just as before, the arrow keys can be used to move the map around the sky; the only difference now is that the arrow keys move the map along the RA/dec grid rather than the alt/az grid.

Let's carry on reducing the field of view; press the "5" key to move to view level 5. The map will look much as before, except that the limiting magnitude will now be 10.0. The other change you may notice is that you'll start seeing stars on the map labelled with letters, as shown below:
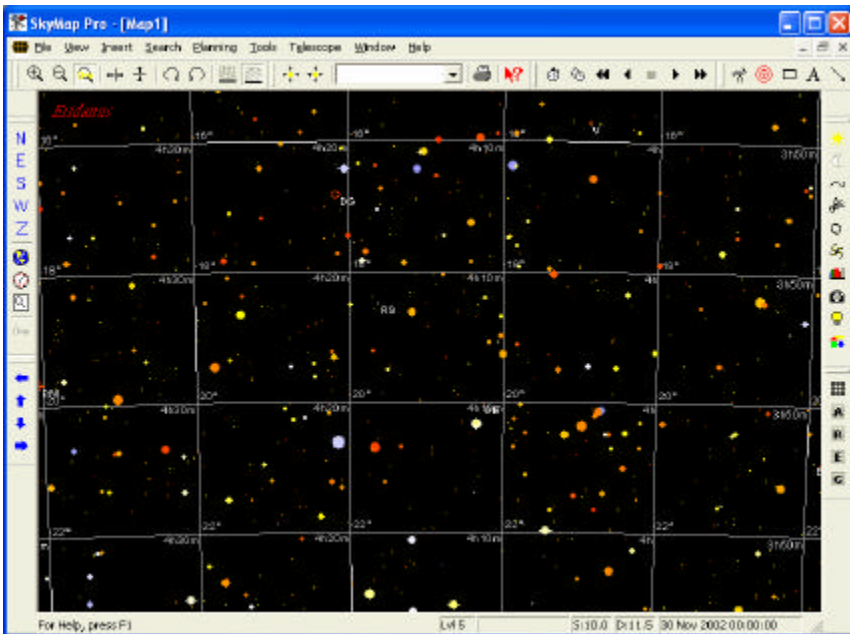
Notice on the above map the stars labelled "V" and "RS". These are *variable stars* - stars whose brightness varies with time. The study of variable stars is a field in which amateur astronomers make major contributions to astronomy, and they are of great interest to many observers. SkyMap has a catalog called the "General Catalog of Variable Stars" which lists all the variable stars known in our galaxy - by default this catalog is switched on (and variable stars labelled on the map) at level 5 and above.

We'll zoom in one final time, this time going straight to level 7 (nothing much changes on level 6). Press the "7" key on the keyboard, and the map will look something like this:
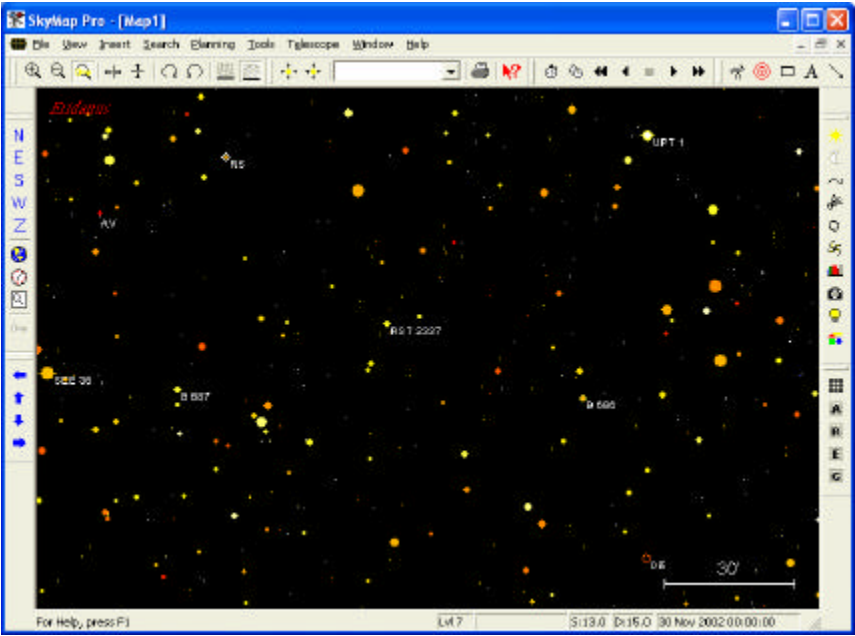
The most obvious thing about this map is that there's no coordinate grid. We're now showing such a small area of the sky that there's very little change in the coordinates from one side of the map to the other. Instead of a coordinate grid we have a "scale line" showing us a sample distance on the map - 30 arc minutes in this case (roughly

the diameter of the Moon). The length of this line can be used to quickly judge distances on the map.

Another thing to note is that we now have some stars labeled with a different type of label, such as the one labeled "RST 2337" in the centre of the map. These are *double stars* (sometimes also called *binary stars*), and again they are a very important area of research in which amateur astronomers can make important contributions. SkyMap, by default, labels double stars with their *namelist identifiers* at view level 6 and above.

The map is now showing very faint stars indeed - the limiting magnitude is 13.0, which is roughly equal to the faintest star visible in a 6" telescope. Most of the stars on the map are being displayed from the "Hubble Guide Star Catalog" (GSC), which SkyMap uses when showing faint stars. The GSC contains some 19 *million* objects and covers the entire sky to roughly magnitude 14-15.

If you wish, experiment further with using the number keys to change the view level, and the arrow keys to move the map around the sky; you'll quickly discover that it's a flexible system which allows you to easily and quickly change from "wide field" views of a large area of the sky to "close up" views of very small areas. The key thing to remember is that whenever the view level changes the position of the map centre doesn't change - all that alters is the field of view. Remember also that you can always get back to one of the standard "wide field" horizon views by clicking the **N E S W** toolbar buttons.

Selecting a specific area of sky

As we've seen, one method of "zooming in" on a specific area of the sky is to firstly bring that part of the sky to the centre of the window with the arrow keys, and then to use the number keys to change the view level.

It's very often the case that you have a map showing a large area of the sky, and you wish to zoom in on a specific rectangular area of that map. SkyMap provides a method for doing this directly, rather than taking the approach described above.

Position the mouse pointer at the top left corner of the area that you wish to zoom in on. Press and hold down the left mouse button, and then "drag" the mouse pointer to the bottom right corner of the area to be zoomed in on; as you move the mouse, a "selection rectangle" will be displayed on the screen:
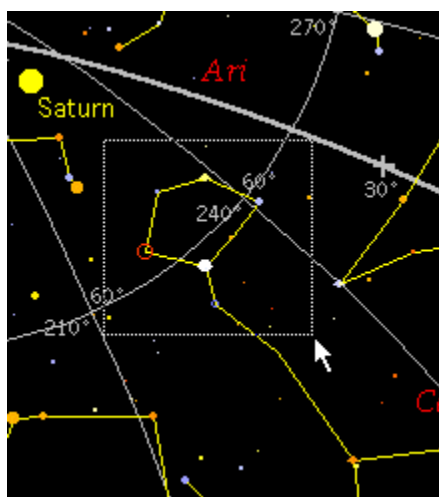
When the selection rectangle surrounds the correct area of the sky, release the left mouse button; a dialog box will appear showing you the coordinates of the centre of the selected region, and letting you change the field of view, if desired:
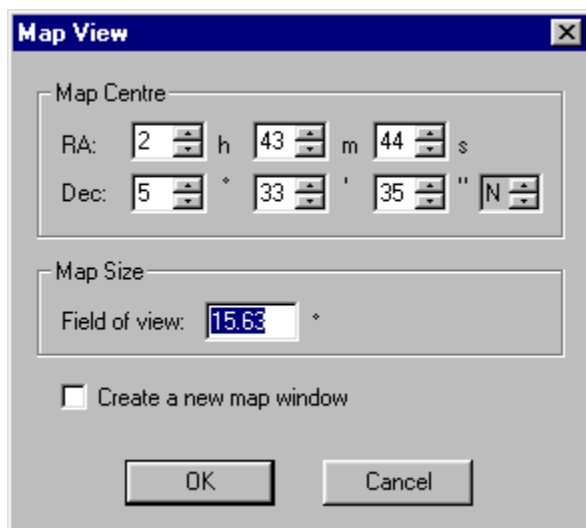
Change the field of view if you wish, and then click the **OK** button. The map will be redrawn showing the desired area of the sky, and the view level will automatically be set to the value closest to the selected field of view:
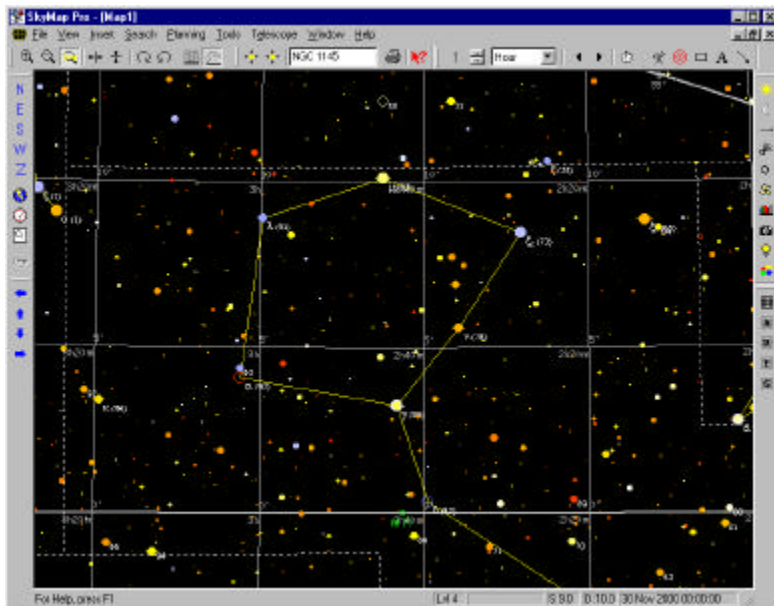
We are now at view level 4 - the selected field of view of 15° lies within the range assigned to level 4.

Returning to an earlier field of view

It will often be the case that you want to display a wide field map showing the sky for a particular date and time, and then look at several different areas of the original map in more detail. As we've seen, you can simply "drag" a selection rectangle on a map to zoom in for a close look at that rectangle, but we've not yet seen how to "undo" that operation to return to the original map.

SkyMap makes this very easy to do; every time the map's field of view changes, SkyMap stores the "old" field of view. To return to the previous field of view press the **Backspace** key on the keyboard, or select the **View/Last View** menu item. Up to 100 previous views are stored; pressing **Backspace** repeatedly will move you back through them, one at a time. Note that the results of a "scroll" are not stored; a view is only stored when the field of view changes as the result of selecting a rectangle, zooming in or out or (as we'll see later) searching for an object.

Try pressing **Backspace** several times; you'll find that each time you do so you'll "undo" another one of the previous operations until eventually you get back to the original southern horizon map view that we started the lesson with.

Summary

In this lesson we've learned how to adjust the map's field of view to look in detail at a small part of the sky, or to get an "overall picture" of a large part of the sky. We can do this either by directly selecting a view level with the number keys on the keyboard, or by dragging a "selection rectangle" to manually select a part of an existing map. We've also learned how to return to previous views by pressing the **Backspace** key.

In the next lesson we'll learn how to adjust the map to match the view through different types of telescopes.

Tutorial Lesson 5 - Rotating or reflecting the map

In the last lesson we learned how to "zoom in" or "zoom out" on the map to change the field of view. This allows us to draw a map showing exactly that part of the sky that we with to look at.

If you've ever used any type of astronomical telescope, you'll know that it rarely, if ever, shows you an image which is the "right way up". Many telescopes give an "inverted" (upside-down) image, while those which use a "diagonal" in front of the eyepiece often give an image which is the right way up, but a "mirror image" left-to-right reflection. Finally, even when you've sorted out which way the image is reflected, you've *still* got the problem that the "star field" seen through the telescope's eyepiece can be at a completely arbitrary angle compared with your star atlas or on-screen map!

All this can be very frustrating for the person attempting to learn how to use a telescope. Not only do you have the difficult task of trying to relate what you're seeing through the eyepiece with the "blobs" on your star map, but you *also* have to contend with odd combinations of rotations and/or reflections of the image.

Fortunately, SkyMap (as always!) comes to the rescue. SkyMap allows you to reflect or rotate the map so that what you see through the eyepiece matches as closely as possible what SkyMap shows you on the screen, or on the printed map.

"Reflecting" the map

SkyMap allows you to "reflect" the map either horizontally, vertically, or both. If you have a Newtonian reflector, you'll want to reflect the map both horizontally and vertically to give a simple "upside down" image; if you have a Schmidt-Cassegrain telescope with a "star diagonal" you'll want to reflect the map horizontally, to give a "right way up", but "mirror image" map.

To reflect the map either horizontally or vertically, two toolbar buttons (initially located along the top of the SkyMap window) are used:

Reflects the map horizontally.

 Reflects the map vertically.

Each of these buttons is displayed "pressed in" when activated, and "pressed out" when not currently active. Simply click the button to activate or deactivate it.

Try it out for yourself. Run SkyMap, and "zoom in" to display a level 4 or 5 view of an arbitrary area of the sky. You'll see a map looking something like the (partial) picture below:
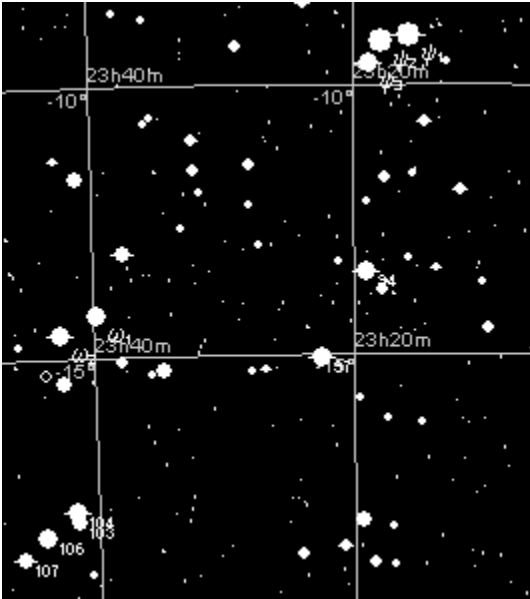
Locate the button on the toolbar. If you hold the mouse over it for an instant you'll see a brief description "Horizontal Flip" appear alongside the mouse pointer telling you what the button does (very useful if you can't remember the purpose of a button). Click the button, and the map will instantly be redrawn to show a "mirror image" view:
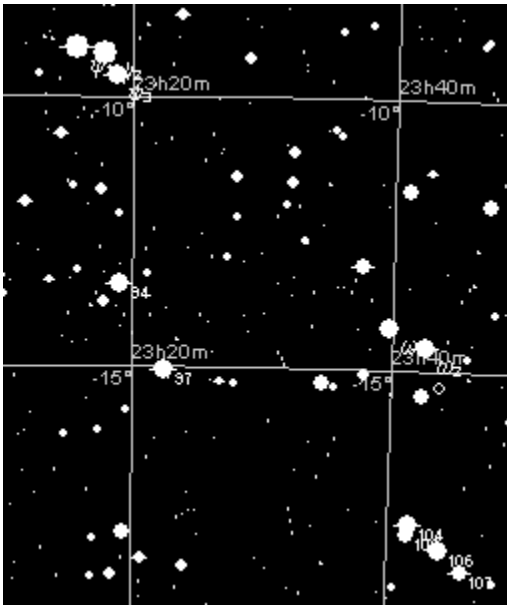
Compare this image with the previous one - everything which was on the left is now on the right, and vice versa. All the labels on the stars and the coordinate grid are still drawn "normally", but notice that now right ascension is increasing from left to right across the map, whereas it increased from right to left on the original map. What we have, in other words, is still a perfectly "correct" map, but one which has been "reflected" horizontally. The stars on this map will now correctly match the view through a Schmidt-Cassegrain telescope used with a star diagonal.

Click the ⊣⊢ button again, and the map will be redrawn as it was originally; each time you click the ⊣⊢ button, the map is reflected horizontally.

Now click the ⬍ button, and notice the effect on the map. This time, it's reflected from top to bottom - stars which were at the top of the map are now at the bottom, and vice versa. Clicking the ⬍ button again will reverse the reflection and restore the original map.

If you have a Newtonian reflector (which virtually all the very popular "Dobsonian" telescopes are), the view you see through the telescope's eyepiece is upside-down. To

display an upside-down map in SkyMap, click both the ⊢⊣ and ⬍ buttons - the combination of both a horizontal and a vertical reflection results in an upside-down map.

Rotating the map

As you know by now, a SkyMap map showing a small part of the sky is normally drawn on an RA/dec coordinate grid. That's fine if you have a telescope on an "equatorial mount" - the vertical and horizontal "axes" of the map will match the "axes of motion" of the telescope. If, however, you have a telescope which is on a simple "alt/az" mount, the "angle" of the star pattern you see in the telescope will very likely be different from the view shown by SkyMap, even when you've got the "reflections" right for your type of telescope.

To deal with this situation, SkyMap makes it easy to rotate the map to any angle you wish, so it matches what you see through the telescope.

To rotate the map clockwise, click the ↻ toolbar button, or press the **Page Down** key on the keyboard.

To rotate the map anti-clockwise, click the ↺ toolbar button, or press the **Page Up** key on the keyboard.

Each time you press the key or click the button, the map will rotate by 1°. To rotate the map by large amounts, press the **Ctrl** key at the same time as **Page Down** or **Page Up** keys on the keyboard – this makes the map rotate in steps of 10° rather than the default 1°. Experiment with rotating the map. Hold down in turn the **Page Down** and **Page Up** keys, and watch the effect it has on the map.

Displaying directions on the map

If you've reflected the map, and then rotated it by some arbitrary amount, it can be quite difficult to figure which direction on the map corresponds, for example, to celestial "north" (ie moving in the direction of the north celestial pole). To aid in this, SkyMap allows you to display a "compass rose" on the map. As you reflect or rotate

the map, the compass rose will *also* be reflected or rotated so it always shows the correct directions.

To switch the compass rose on or off, first click the to display the Miscellaneous items dialog, as shown below:
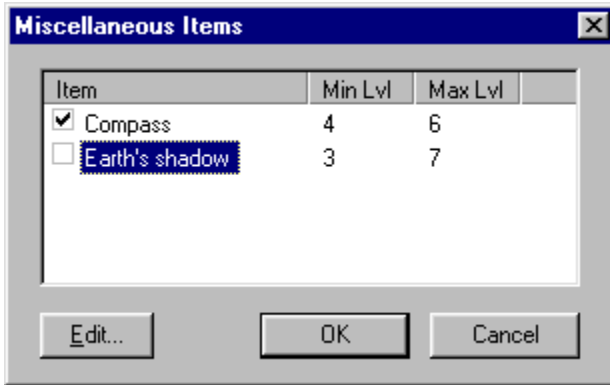
Next, click the check box to the left of the "Compass line, and then click the **OK** button to dismiss the dialog.

If you don't already have a map on display, zoom in to show a level 4 or 5 view of any part of the sky you wish, and then switch on the compass, as described above. The compass rose will be displayed in the upper left corner of the map window, looking something like this:

Notice that an arrow marks the "N" branch of the compass - this always points in the direction of the north celestial pole.

Click the toolbar button, and look at the compass rose again; you'll see that "E" and "W" have been swapped around, because the map has now been reflected horizontally:

Now press and hold down the **Page Down** key on the keyboard, and rotate the map through some arbitrary angle. Watch the compass rose as the map rotates, and notice how it rotates with the map. After a while, stop the rotation; the compass may look something like this:

Experiment further with rotation and reflection; you'll find that no matter what the angle of the map, the compass rose will still correctly show the "orientation" of the map.

Summary

In this lesson we've learned how to rotate and reflect the map so it correctly matches the view through any type of telescope. We've also learned how to switch on and off the "compass rose" to visually show the map's current orientation.

SkyMap contains a lot more than simply "dots" on the screen; there's a huge quantity of information available on all the objects on the map. In the next lesson we'll learn how to display information about any object on a map.

Tutorial Lesson 6 - Displaying information about objects on the map

We've now seen how to display a map showing any part of the sky, in whatever level of detail we wish, for any time and date, as seen from any location on Earth. There's a lot more to SkyMap, however, than simply being able to display "dots" on the computer screen. Behind each "dot" in SkyMap's many databases is a large quantity of information which can be displayed about any object.

Displaying "quick information about an object

As you will almost certainly have noticed by now, you can see brief information about any object on the map simply by positioning the mouse over the object and waiting for 1 second. For example, if you place the mouse pointer over a star, you'll see something like this:
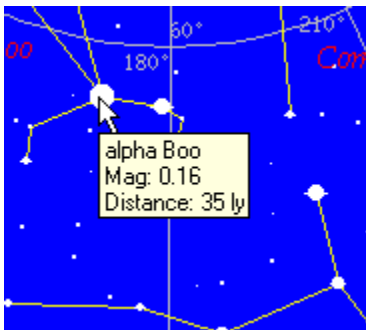
This tells us that the star is called "alpha Boo (the brightest star in the constellation Bootes), has a magnitude of 0.16, and is 35 light years from the Sun (note that distances out to a few hundred light years are reliable; distances shown beyond that are meaningless and should be ignored!).

The information displayed varies with the type of object. Place the mouse pointer over a planet, for example, and you'll see something like this:
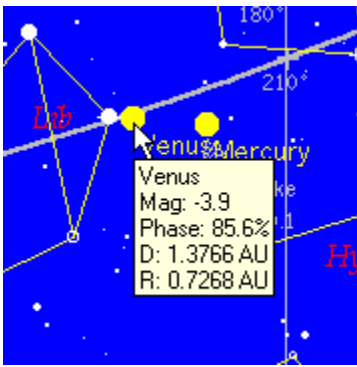
This is telling us that Venus (the planet we placed the mouse pointer over) currently has a magnitude of –3.9, and a phase of 85.6%. Its distance from the Earth (the "D line") is 1.3766 AU, and its distance from the Sun (the "R line") is 0.7268 AU (1 AU, or "astronomical unit, is the average distance between the Earth and the Sun, and is equal to 150 million km, or 93 million miles; distances within the Solar system are conventionally measured in AU).

Displaying information about a planet

Run SkyMap, and select the standard southern horizon view, as usual. Now, using the cursor keys, scroll the map around the sky until you see a planet such as Mars, Jupiter, or Saturn. This will be shown as a large yellow dot with the planet's name immediately below, eg:

To display information about the planet (Saturn, in this case), position the mouse pointer over the planet's "dot" on the map, and click the *right* mouse button. A "pop-up" menu will appear:

Depending on what's on the map near the mouse, the menu may contain other items - don't worry about them for the moment.

Move the mouse over the menu to select the "About Saturn..." menu item, as shown (obviously the name shown on the menu will be whichever planet you've clicked the mouse over):

When the correct menu item is highlighted, click the mouse button; the menu will disappear, and a second or two later a dialog box will appear containing information about Saturn (or whichever planet you've chosen):

```
About Saturn                                           [×]
View  Tools

 ┌─────────────────────────────────────────────────┐ ▲
 │ Information about Saturn for 05 Nov 1998 00:15:35 │ █
 │ (Julian day number 2451122.71916)                │ █
 │                                                   │ █
 │ Local Information                                 │ █
 │                                                   │ █
 │ Apparent topocentric coordinates for the epoch of date: │
 │                                                   │
 │ Right ascension: 1h 52m 27.26s                    │
 │ Declination: +8° 36' 16.3"                        │
 │ Constellation: Pisces                             │
 │                                                   │
 │ Altitude: 67° 47' 39"                             │
 │ Azimuth: 221° 59' 18"                             │
 │                                                   │
 │ Rise: 16h 54m 5s                                  │
 │ Transit: 23h 12m 15s                              │
 │ Set: 5h 34m 40s                                   │
 │                                                   │
 │ Star atlas chart numbers:                         │
 │                                                   │
 │ Herald-Bobroff Astroatlas, Chart C-55             │ ▼
 └─────────────────────────────────────────────────┘
                                        [   OK   ]
```

As you can see, the information dialog contains a main "text" area which shows the main information, and a menu bar along the top of the dialog. Several "screens" of text are available - use either the scroll bar or the cursor keys on the keyboard to scroll through the available information.

The information shown will depend on the planet, but it's divided into several "sections" as follows:

The top of the information shows the local time and date for which the information is applicable, and also the "Julian day number". Julian day numbers are very widely used in astronomy - they are simply a sequential "count" of days starting at noon on January 1st, 4713 BC.

The "Local Information" section of the dialog shows information about the planet as it seen from the map's current "observer's location" - such information is called "topocentric coordinates". The dialog shows the apparent right ascension and declination of the planet, the constellation which it's in, its altitude and azimuth, and

the time that it rises, "transits the meridian" (ie is due south in the northern hemisphere, or due north in the southern hemisphere), and sets. Also shown are page references for that part of the sky in a number of different printed star atlases.

The "Geocentric Information" section of the text shows information about the planet as it would (theoretically) be seen from the centre of the Earth. This information includes the apparent right ascension and declination of the planet, and the "straight line" distance between the planet and the Earth in "astronomical units". Astronomical units are the normal method of expressing distances within the solar system; 1 "AU" is equal to the average distance between the Earth and the Sun, and is equal to 150 million kilometres, or 93 million miles.

The "Heliocentric Information" section lists data for the planet as seen from the Sun. The ecliptic longitude and latitude are shown, together with the "radius vector", which is simply the distance of the planet from the Sun, in astronomical units.

The final section of the dialog lists "Physical Information", and provides information on such things as the magnitude (brightness) of the planet, its phase (the fraction of the planet's disk which is illuminated by the Sun), the elongation (the "angular separation" of the planet from the Sun), and the apparent size of the planet in seconds of arc. Also listed are physical quantities such as the mass of the planet, its rotation period, radius, mean density, and so on.

The items on the **View** menu below the dialog provide additional display options:

The **Picture** item allows you to view a picture of the planet, if one is available (SkyMap allows you to associate a picture with any object - this is described in detail elsewhere in the manual). Selecting this menu item will run a separate "picture viewer" program to display the picture.

The **Diagram** item displays a diagram of the planet, typically showing its general appearance; the diagram shown varies with the planet.

The **Copy** item copies all the information to the Windows "clipboard", from where it can be "pasted" into any other application. Try it now - click the "copy" button, then run your favorite word processor and use its "paste" option. You should see all the information from the dialog appear in the word processor.

The items on the **Tools** menu provide options associated with observation logging and planning - these are described in detail in separate chapters in the manual.

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Displaying information about a star

To display information about a star, follow exactly the same procedure as you did earlier to show information for a planet - position the mouse pointer over the star, click the right mouse button, and select the "About..." menu item:

One thing to note about stars is that the "About" menu option can show the "name" of the star in several different ways. If, as is the case in the picture above, the star is a bright star, it may well have a "traditional" name - "Betelgeuse" in this case. Other bright stars in a constellation will probably have either a Greek letter ("Bayer letter") name, or a number ("Flamsteed number") name, such as "kappa Oph", or "61 Cyg" (the constellation name will be a standard "3 letter abbreviation" for the constellation - a table in the appendices of this manual lists the names and abbreviations of all the constellations). Finally, if the star is faint, it will probably be displayed as a catalog number such as "TYC 5877-890-1", or "GSC 5133-0948". The first of these indicates that the star is in SkyMap's main star catalog, the Tycho catalog, while the second is a reference to SkyMap's "faint star" catalog - the "Hubble Guide Star Catalog".

However the star is described, clicking the "About..." menu item will display an information dialog for the star. Many stars are in several of SkyMap's catalogs, so it can take a few seconds to "compile" all the information which is to be displayed. When the information dialog is displayed, it will look something like this:

Summary

Visual magnitude: 0.45
Spectral type: M2Ib
Distance: 427 +/- 76 light years
Luminosity: 9199 +/- 3543 x Sun's luminosity

Position information for 05 Nov 1998 00:15:35
(Julian day number 2451122.71916)

Apparent RA (epoch of date):   05h 55m 06.81s
Apparent Dec (epoch of date):   +7° 24' 21.2"
Constellation: Orion

Altitude: +42° 42' 49"
Azimuth: 104° 31' 41"

Rise: 20h 58m 37s
Transit: 3h 18m 27s
Set: 9h 34m 22s
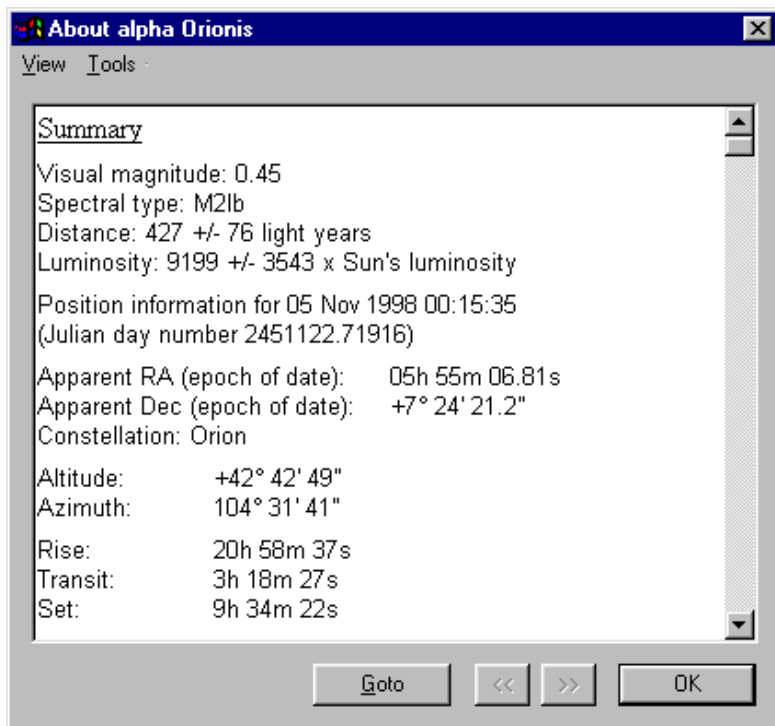
The dialog contains a great deal more information than will fit onto a single page - use the scroll bars or the cursor keys to scroll through the text.

The "Summary" section of the dialog summarises the most important facts about the stars - its visual magnitude, spectral class, distance, luminosity, position, rise and set times, and so on.

The "Names and Catalog Numbers" section of the dialog displays all the names by which the star is known - most stars have several different names!

The "Star Atlas Chart Numbers" section the page number on which the star appears in several popular star atlases.

Following this "general" information, which is shown for all stars, the information dialog will then list in detail the star's "record" in each SkyMap catalog in which it appears. Some stars will only appear in one catalog, others will appear in 3 or 4

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different catalogs. In general, bright stars will have more information available than faint stars.

Displaying information about a deep sky object

You should already now know how to display information about a "deep sky object" such as a galaxy, nebula, or star cluster; simply position the mouse pointer over the object, click the right mouse button, and select the "About..." menu item:

One important different between deep sky objects and the other map symbols we've discussed previously is that, as shown in the picture above, when you "zoom in" on a deep sky objects you may well see a quite large "shape" rather than a small symbol. To display information about the object, you must click the mouse close to the "centre" of the shape. This will always be somewhere on the line running upwards from the centre of the object's label.

Clicking the "About..." menu item will display an information dialog for the deep sky object. As with stars, many deep sky objects are in several of SkyMap's catalogs, so it

can take a few seconds to "compile" all the information which is to be displayed.
When the information dialog is displayed, it will look something like this:
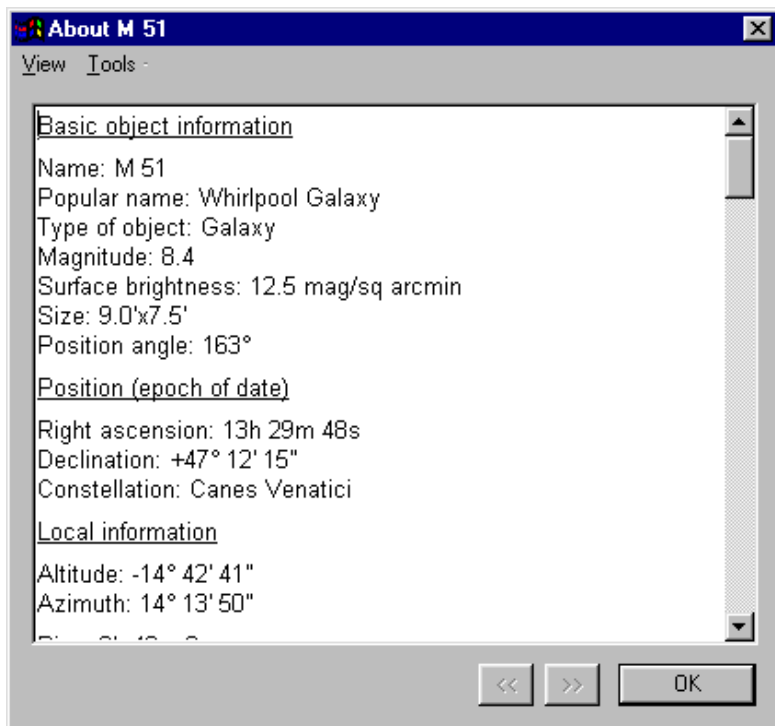
As with the other information dialogs, this one is divided into "sections", each
providing different information.

The "Basic object information" section at the top of the dialog provides the most
"fundamental" information about the object, such as its primary "name", what type of
object it physically is and, if available, its brightness, size, and shape.

The "Position" section gives the current right ascension and declination of the object,
together with the name of the constellation that the object is in.

The "Local information" section gives the object's current altitude and azimuth, as seen from the observer's location, and the time that the object rises, transits the meridian, and sets.

After this initial information, which is provided for all objects, the dialog will list all the information about the object for each of the catalogs in which the object appears.

Summary

In this lesson we've learned how to display information about any object on a map by clicking the right mouse button over the object, and selecting the "About <object name>" menu item. We've learned how to copy the displayed information to the clipboard, so it can be pasted into another application.

In the next lesson we'll learn how to use SkyMap's extensive search facilities to locate objects.

Tutorial Lesson 7 - Searching for objects

In the previous lesson we saw how to display information about any object on the map. That's a very useful capability, but SkyMap contains many *millions* of objects, and we may not always know where the object we want to know about is located in the sky. Another problem we have to contend with is the fact that most objects are known by many different names and catalog numbers, and the name we're interested in may not be the name which SkyMap uses to label the object on the map. For example, the bright galaxy "M86" is also known as "NGC 4406", "UGC 7532", "MCG 2-32-46", "CGCG 70-72", "PGC 40653", and "VCC 881", to name only a few of its numerous catalog numbers; if we read an article which referred to "UGC 7532", and then saw a galaxy labelled "M86" on the map, we probably wouldn't know that it was the same object! Fortunately, we don't need to memorize all the different names and catalog numbers each object has; SkyMap makes it easy to locate any object using any of the names that object may be known by.

Searching for a planet, Sun, or Moon

Let's search for a planet on the map. Run SkyMap, move the mouse pointer to the menu bar at the top of the SkyMap window, and select the **Search/Planet...** menu item:
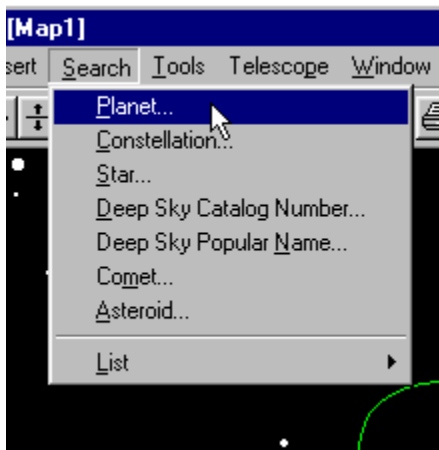
The "Find planet" dialog will be displayed:
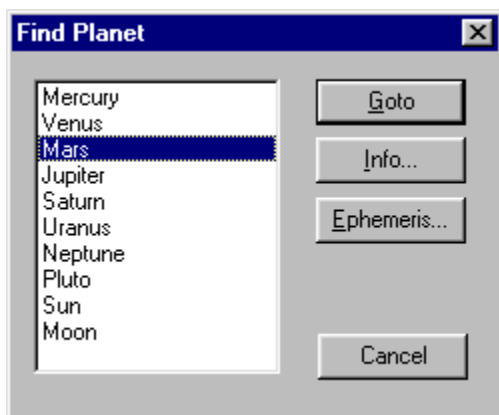
Use either the cursor keys or the mouse to select any name in the list, then click the **Goto** button. The map will be redrawn centred on the selected planet (Mars in this case):

The white square is called the "search target marker", and marks on the map the location of the object which has most recently been searched for. Scroll the map around the sky, or change the view level by pressing the number keys; you'll find that the marker will remain on the map. To make it disappear, select the **View/Hide Search Target** menu item, or press the "**T** key on the keyboard.

Now try displaying the information dialog for a planet directly, without having to first locate the planet on the map and right click on it. Display the "Find planet" dialog as you did before, select a planet (or the Sun or Moon), and this time click the **Info** button. The information dialog for the chosen object will be displayed.

Searching for "deep sky objects" by popular name

A "deep sky object" is any object outside our solar system *except* a star; the name is a "collective term" used to refer to such things as galaxies, star clusters, nebulae, and so on. All deep sky objects have catalog numbers - indeed, most have *many* catalog numbers as we've already seen! Many of the brightest deep sky objects also have "popular names" by which they're often referred to, such as "Andromeda Galaxy", "North America Nebula", "Blinking Planetary", and so on. SkyMap lets use search for deep sky objects using either a catalog number or a popular name.

Let's see how to do this. Run SkyMap, then press the number "5" on the top row of numbers; you'll now be looking at a fairly "close up" view of some arbitrary part of the sky. Let's look for the "Andromeda Galaxy" - a large galaxy visible to the naked eye in dark skies as a faint patch of "mist", and easily visible through binoculars from anywhere in the northern hemisphere. Move the mouse to the menu bar at the top of the SkyMap window, and select the **Search/Deep Sky Popular Name...** menu item:
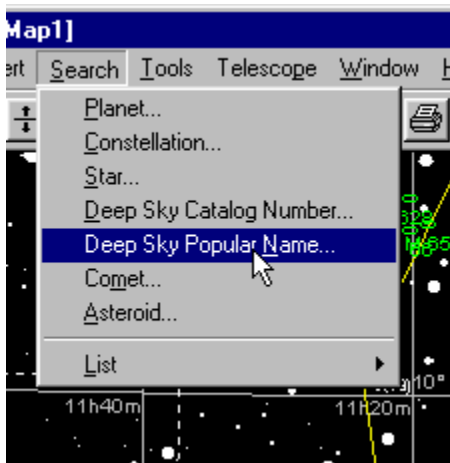
Doing this will display the "Find object by popular name" dialog box:
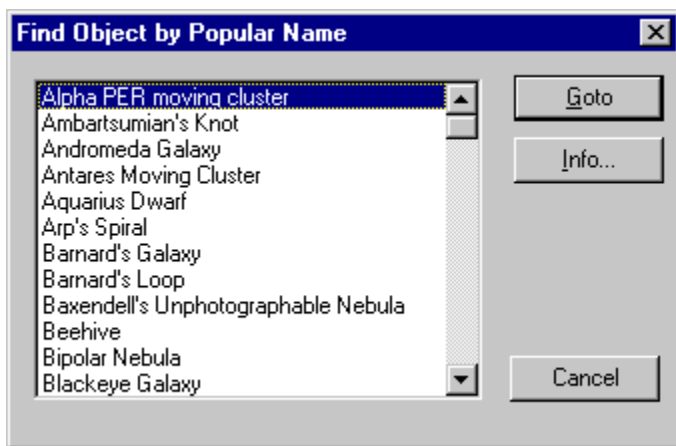
The list on the left side of the dialog lists all the popular names which SkyMap knows about; use either the cursor keys on the keyboard, or the scroll bar to move up or down the list. On the right side of the dialog are three buttons:

- ??**Goto**, which moves the map to the location of the object currently selected in the list.

- ??**Info**, which displays the information dialog for the selected object, leaving the map unchanged.

- ??**Cancel**, which allows us to change our mind, and exit the dialog without doing anything at all.

We want to locate the Andromeda Galaxy on the map. Look at the list of names, and you'll see "Andromeda Galaxy" close to the top of the list. Click on the name to select it (or use the "down arrow" key on the keyboard), then click the **Goto** button. The dialog will disappear, there will be a brief pause while SkyMap draws a new map, and then the map will appear looking something like this:
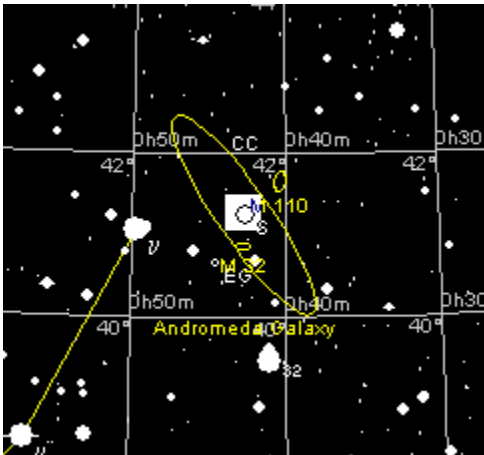
Note the large "oval" of the galaxy, with the name "Andromeda Galaxy" below it. As always, the search target marker - the white square - shows which object has been located by the search.

Try searching for some of the other objects in the popular name list in the same way; you'll soon find that some are shown on the map after the search operation, but others aren't. That's because the search operation always takes you to the *position* of the object being search for, but the current map settings often mean that the object itself isn't visible; we'll learn how to change map settings later.

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It's very often the case that all we want to do is display information about an object, rather than actually see it on the map. To do this, use the search dialog in exactly the same way you did before, but this time, click the **Info** button rather than the **Goto** button; this will leave the map unchanged, and simply display the information dialog for the selected object.

Searching for deep sky objects by catalog number

Most deep sky objects don't have a "popular name" - if we want to find them, we need to know their catalog number, or at least *one* of their catalog numbers, since most objects have several. Most objects visible in small telescopes with either be in the "Messier Catalog" or the "New General Catalog", and will have catalog numbers starting in "M" or "NGC" respectively.

Let's look for the bright galaxy M86 which we talked about at the start of this lesson. If SkyMap isn't already running, run it, and this time press "7" to display a level 7 map of some arbitrary part of the sky. Select the **Search/Deep Sky Catalog Number...** menu item:
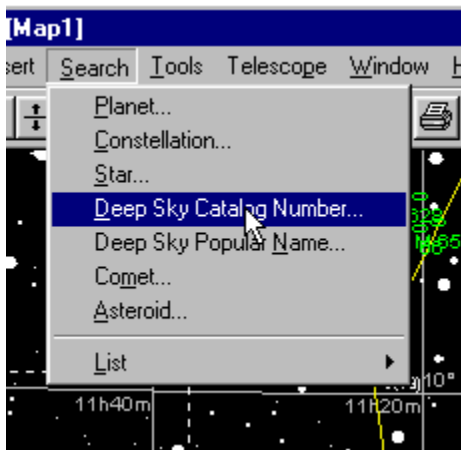
Select this menu item and the "Find deep sky object by catalog number" dialog will be displayed:
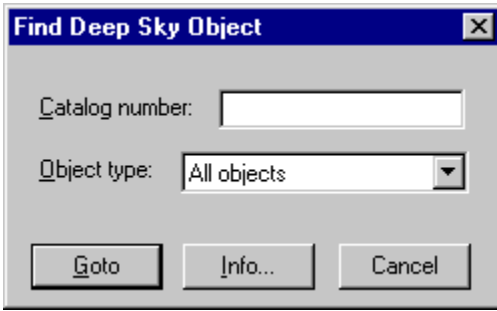
Type "M86" into the text field, then click the **Goto** button to locate the object. The map will be redrawn, with the white search target marker showing the position of M86:

Remember that we said at the start of this lesson that M86 had many other possible names as well? Repeat the above procedure, but this time search for "UGC 7532"; you'll find that exactly the same map will be displayed - "UGC 7532" ("UGC" stands for "Uppsala General Catalog of Galaxies") is an alternative name for "M86". This illustrates an important point - when you search for an object, the name with which the object is labelled on the map will *not* necessarily be the same as the name that you searched for, but the search target marker will always show the correct position of the object.

Searching for a star

To search for a star, select the **Search/Star...** menu item; the "Find star" dialog will be displayed:

Find Star

Star name

Bayer letter
α

Constellation
Andromeda

Proper name
Acamar

Goto   Info...   Cancel

This dialog allows you to locate stars using many different methods; if you press the **F1** function key whilst the dialog is visible, they will all be explained. We'll describe here three of the most commonly used methods of identifying stars. The important thing to remember about this dialog is that all that SkyMap takes any notice of is what's in the "Star name" text field at the top of the dialog - everything else on the dialog just provide a "shortcut" for entering information into this field.

Many of the bright stars in the sky have a "proper name". For example, the "pole star" is called "Polaris"; the bright red star at Orion's "shoulder" is called "Betelgeuse". The combo-box in the "Proper name" section of this dialog lists all the proper names which SkyMap knows about.

Let's find "Betelgeuse" on the map. Run SkyMap and display the "Find Star" dialog. Click on the "down arrow" at the right side of the proper name combo-box (the box

showing "Acamar" in the picture above), and the list will "drop down". Scroll through the list until you find "Betelgeuse" (alternatively, type the first few letters of the word, and Windows will scroll the list to the correct point):
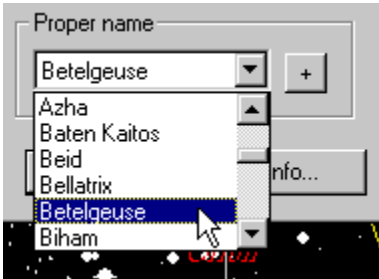
Click on the name "Betelgeuse". The list will close, with the name "Betelgeuse" shown selected. Now click the "+" to the right of the combo-box. The name "Betelgeuse" will be copied into the "Star name" field:

Finally, click the **Goto** button at the bottom of the dialog. The map will be redrawn centred on the position of Betelgeuse. As with all search operations, the search target marker will show which object has been "found" by the search.

Try searching for other stars with "proper names". You can either use the "+" button alongside the list of names to copy a name to the "Star name" field, or you can directly type the name into the "Star name" field - either will work.

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Most stars in the sky don't have a proper name. As you known, the sky is divided into 88 constellations, each constellation occupying a fixed "area" of the sky. The brightest stars in each constellation are labelled with Greek letters, normally called "Bayer Letters" after the man who originally invented this system of labeling stars. As a general rule (to which there are many exceptions!) the brightest star in each constellation is labelled "?" (alpha), the second brightest is labelled "?" (beta), and so on through the Greek alphabet (if you're unfamiliar with the Greek alphabet, it's shown in full in one of the appendices at the end of this manual).

Let's now see how to find a star which is labelled with a Greek letter. We'll search for "? Orionis", which is another name for Betelgeuse. Display the "Find star" dialog as before. This time, we have to enter two items of information; the Greek letter, and the constellation. To enter the Greek letter, click the list in the "Bayer letter" section of the dialog, select "?" from the list, then click the "+" button alongside the list. The letters "alp" will appear in the Star name field (SkyMap uses the first three letters of the "English" version of the Greek letter):
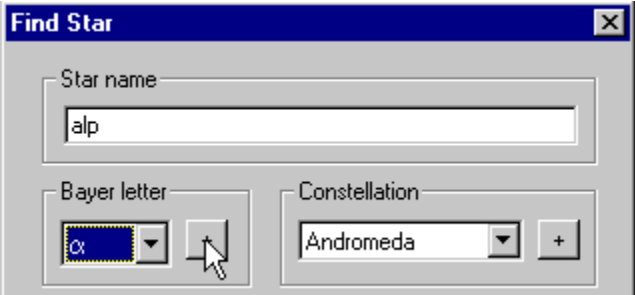
Next, go to the "Constellation" section of the dialog, select "Orion" from the list, and click the "+" button alongside the list. The letters "Ori" (the standard 3-letter abbreviation for the constellation of Orion) will be added to the text in the Star name field:
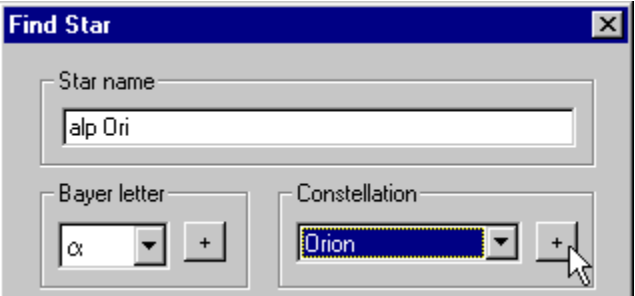
Finally, click the **Goto** button. The map (if it is not already doing so) will be redrawn, centred on Betelgeuse.

The final common method of referring to stars is to use their "Flamsteed numbers". Flamsteed numbers are typically used for those relatively bright stars in each constellation which don't have a Greek letter associated with them. Let's search for the star "61 Cygni", which is one of the closest stars to our solar system.

Run SkyMap, and select view level 4; this is the level at which, by default, Flamsteed numbers are switched on. Display the "Find star" dialog, and type "61" into the Star name field (there's no "shortcut" method of entering numbers!). Then, exactly as we've already done for Bayer letters, go to the "Constellation" section of the dialog, select "Cygnus" from the list, and press the "+" button; the letters "Cyg" (the abbreviation for "Cygnus" will be added to the star name field:
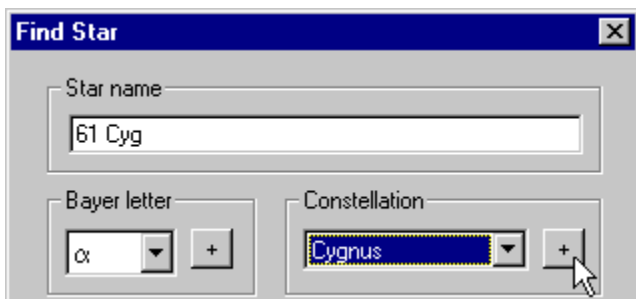
Finally, click the **Goto** button, and the map will be redrawn, centred on 61 Cygni:
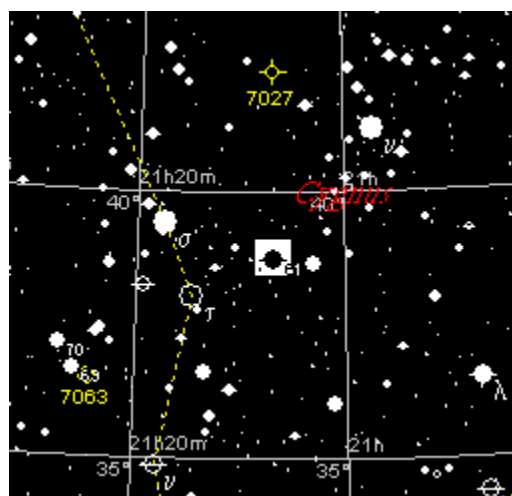
Tutorial Lesson 8 – Artificial satellite predictions

One of SkyMap's capabilities is the ability to predict "visible passes" of artificial satellites across the sky. In this lesson, we illustrate how to use this feature of SkyMap.

There are well over one thousand "active" satellites orbiting the earth today, and many thousand more dead satellites, bits of rockets, and other pieces of "debris". The North American Aerospace Defense Command (NORAD) tracks every significant item in earth orbit and, for the vast majority of such objects, publishes freely available orbital data for them which can be used to predict their orbital position and visibility as seen from any point on the Earth's surface. At the time of writing (October 2001) there are well over a hundred satellites which can easily be seen with the naked eye, and a small telescope or a pair of binoculars enables many hundred more to be seen.

NORAD issue orbital elements in the form of "two line elements" (TLEs), a standardized method of representing orbital elements which allows all the relevant information to be issued in a very compact format. These TLEs can be freely downloaded from a large number of different Internet web sites.

Unlike comet and asteroid orbital elements which can be reliably used for many months, satellite orbits are constantly changing due to both orbital maneuvering by the satellite and the effects of atmospheric drag. Because of this, a set of satellite orbital elements very rapidly "ages" and for accurate predictions *must* be updated every few days. A satellite prediction calculated from orbital data more than a few weeks old will generally be virtually meaningless.

Because of this, no satellite orbital data is supplied with SkyMap; in order to display satellite positions you must download a current set of TLEs for the objects which interest you from the Internet. There are many sites from which TLEs can be downloaded - a few are listed below:

http://oig1.gsfc.nasa.gov/
`http://www.celestrak.com`

ftp://kilroy.jpl.nasa.gov/pub/space/elements/

http://www2.satellite.eu.org/sat/vsohp/satintro.html

http://www.r-clarke.org.uk/keplers/elements.htm
`ftp://ftp.satellite.eu.org/pub/sat/mirrors/elem/`

http://wwwvms.utexas.edu/~ecannon/elements.htm

http://www.fc.net/~mikem/tle.html

On web sites, TLEs for different "groups" of satellites are normally collected together into a single file which can be downloaded; for example, one will commonly find a file containing data for all bright visual satellites, one for geostationary satellites, one for communications satellites, and so on.

After downloading the data file, the next step is to load the file into SkyMap. To do this, select the **Tools/Satellites/Load TLE Data...** menu item; the Satellite Selection Dialog will be displayed:
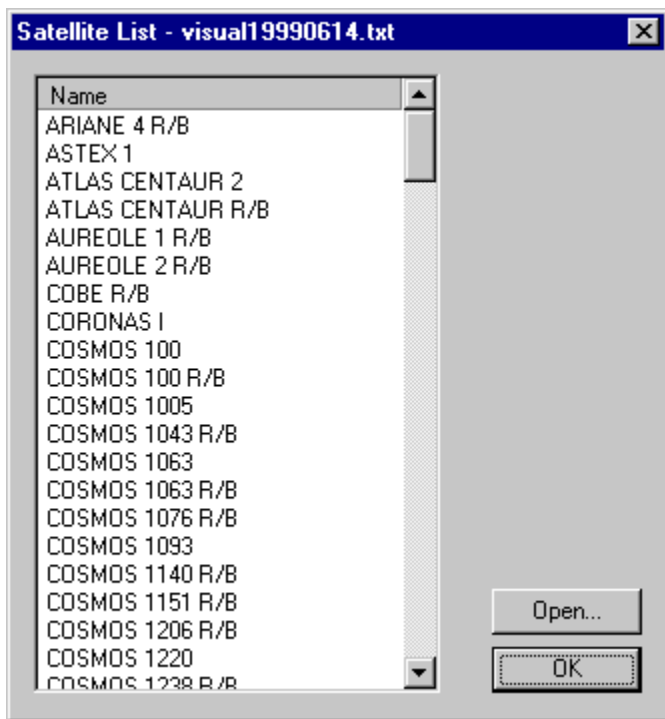
The title bar of the dialog shows the name of the data file currently loaded (if any), and the list displays the names of all the objects in the current file. To load a new data

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file, click the **Open** button and select the file from the standard file selector; the file will be read, and the names of all the objects contained in it will be displayed in alphabetical order in the list.

You can display the orbital elements of any satellite in the list by double clicking that line in the list. For example, to display the orbital elements of the International Space Station, scroll down the list until you reach "ISS", then double click the line. The orbital elements will be displayed in the Satellite Orbital Elements Dialog :

Satellite Orbital Elements

Name: ISS (ZARYA)
NORAD catalog number: 25544
International designator: 98067A

Epoch of element set: 1999-Jun-11 11:55:16 UT
Element set number: 680

Drag coefficient (B*): 0.00021598
Inclination: 51.5932°
RA of ascending node: 226.4607°
Eccentricity: 0.0011402
Argument of perigee: 332.8937°
Mean anomaly: 27.1480°
Mean motion: 15.58732374 revs/day

[Copy]   [OK]

Note that once you've selected a data file, SkyMap will continue to use that data file for all future runs of the program until you tell it to load a different file. Do bear in mind, however, the warnings previously given about the rapidity with which TLEs become obsolete - if you want accurate predictions you should update the TLE data at least once a week.

Displaying the ground track of a satellite

The "ground track" of a satellite is its path over the Earth's surface - ie, a line connecting all the points over which the satellite passes directly overhead. It's always useful to display the ground track of a satellite to check whether or not it's ever visible from your location - many satellites are in low inclination orbits and so cannot be seen by observers in high latitudes.

To display the ground track of a satellite, select the **Tools/Satellites/Ground Track...** menu item; the first page of the Satellite Ground Track Dialog will be displayed, as shown below:
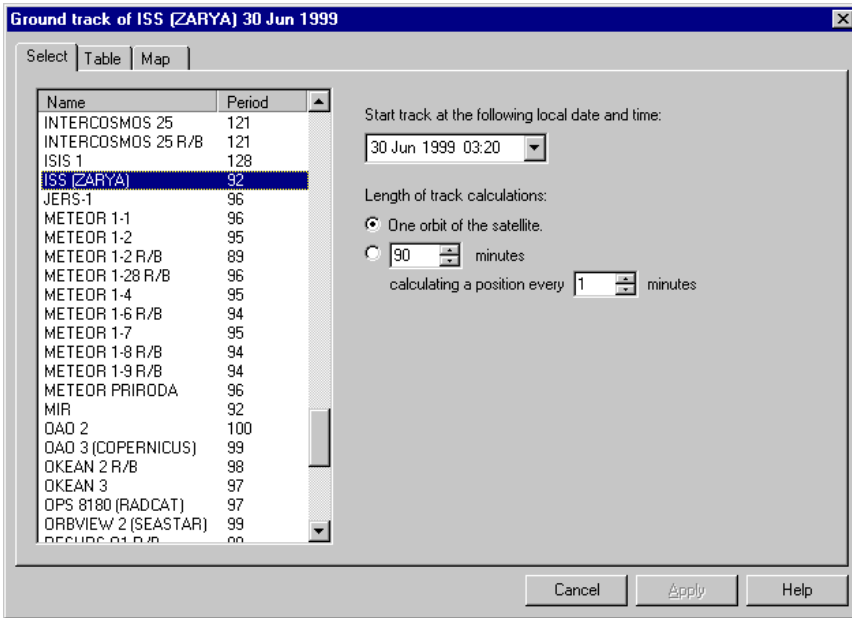
The list on the left side of the dialog shows the names of all the objects in the current data file, together with each object's orbital period in minutes. Click on the object you wish to display a ground track of to select it.

The standard date selector on the right side of the dialog allows you to enter the date and time for which the ground track display should start; this is based on the time zone of the observer's position defined on the current star chart. To change any

"component" of the date or time, click on it with the mouse to highlight it, then use the up and down arrow keys on the keyboard to increase or decrease the value.

The "length of track calculation" section of the dialog allows you to choose the length of the displayed ground track; you can either display a track for a single orbit of the object, or you can manually enter the length of the track, and the interval at which positions are to be calculated.

When all the information has been set up correctly, click the **Table** tab at the top of the dialog to display the ground track in a tabular form, or click the **Map** tab to display it graphically as a line on a world map. Each of these will be described in detail below.

Tabular display

Clicking the **Table** tab at the top of the ground track dialog displays the ground track in the form of a table, as shown below:

Ground track of ISS (ZARYA) 30 Jun 1999   ☒

Select | **Table** | Map |

Time	Latitude	Longitude	Altitude	Speed	Vis
30 Jun 1999 03:20	46°14'25"N	124°23'40"W	387.3	7.688	
30 Jun 1999 03:21	47°51'53"N	119°26'14"W	387.9	7.687	
30 Jun 1999 03:22	49°14'18"N	114°10'19"W	388.5	7.687	
30 Jun 1999 03:23	50°20'05"N	108°37'33"W	389.0	7.687	
30 Jun 1999 03:24	51°07'48"N	102°50'47"W	389.5	7.686	
30 Jun 1999 03:25	51°36'19"N	096°54'01"W	390.0	7.686	
30 Jun 1999 03:26	51°44'55"N	090°52'14"W	390.4	7.685	
30 Jun 1999 03:27	51°33'22"N	084°50'53"W	390.8	7.685	
30 Jun 1999 03:28	51°02'01"N	078°55'25"W	391.1	7.684	
30 Jun 1999 03:29	50°11'37"N	073°10'40"W	391.3	7.684	
30 Jun 1999 03:30	49°03'23"N	067°40'29"W	391.5	7.683	
30 Jun 1999 03:31	47°38'48"N	062°27'29"W	391.7	7.683	
30 Jun 1999 03:32	45°59'27"N	057°33'08"W	391.8	7.682	
30 Jun 1999 03:33	44°06'59"N	052°57'50"W	391.8	7.682	UMB
30 Jun 1999 03:34	42°02'59"N	048°41'13"W	391.9	7.681	UMB
30 Jun 1999 03:35	39°48'57"N	044°42'19"W	391.9	7.681	UMB

Save... | Copy | Time: | +1 Orbit | -1 Orbit |

Cancel | Apply | Help

For each point on the track, the following information is shown:

Time	The time and date at which the satellite is at this position, in the time zone of the observer on the current star chart.
Latitude	The geographic latitude of the point on the Earth's surface directly below the satellite.
Longitude	The longitude of the point on the Earth's surface directly below the satellite.
Altitude	The height of the satellite above the Earth's surface, in the units specified on the Satellite Configuration Dialog .
Speed	The speed of motion of the satellite in its orbit, in the units specified on the Satellite Configuration Dialog.
Vis	The "visibility" of the satellite - ie, whether it is sunlit or eclipsed (passing through the Earth's shadow). If the column is blank, as it is in the illustration above, the satellite is in sunlight; if the satellite is eclipsed, the column will show either "PEN" or "UMB" indicating that the satellite is in either the penumbral or umbral shadow of the Earth.

The **Save** and **Copy** buttons allow you to respectively save the displayed information as a text file, or copy it as text to the Windows clipboard, from where it can be pasted into another application.

The **+1 Orbit** and **-1 Orbit** buttons allow you to move the time respectively forward or backward by a length of time equal to the satellite's orbital period; when one of these buttons is clicked a new ground track will be calculated for the new starting time and shown in the table.

Graphical display

Clicking the **Map** tab will display the ground track graphically, in the form of a line on a world map, as shown below:
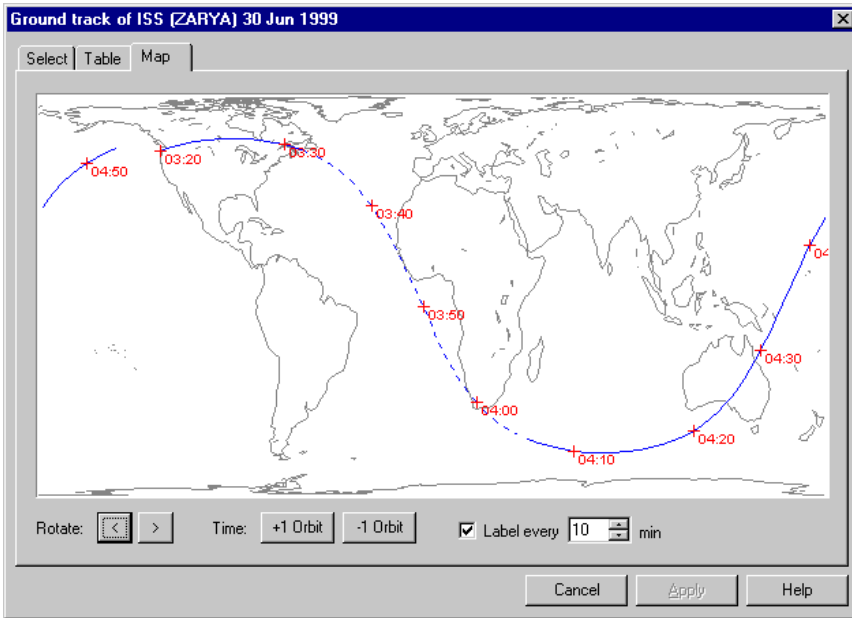
The map displays the entire world using a cylindrical map projection; this results in a good display of low latitudes, but severe distortion at high latitudes.

The solid portions of the line indicate that the satellite is sunlit at that time, the dotted portions of the line indicate that the satellite is eclipsed (ie, in the Earth's shadow) at that time. The time markers along the track are in the time zone of the observer on the current star chart.

The **Rotate <** and **Rotate >** buttons scroll the map to the left or right, allowing different parts of the track to be viewed mo re easily.

The +**1 Orbit** and **-1 Orbit** buttons move the time forward or backward by the satellite's orbital period and display a ground track for the new time period; this allows you to easily view the satellite's position over an extended period of time - for example, to see if and when it passes over a particular part of the world. When changing the time, it's helpful to note that the date is always displayed in the title bar of the dialog.

The **Label** check box allows you to switch the time labeling of the ground track on or off. The text field to the right of the check box allows you to alter the spacing of the labels.

Predicting and displaying satellite passes

The most useful satellite operation offered by SkyMap is its ability to predict and display the "pass" (ie the appearance) of a satellite as seen from a specific location. Satellite passes can be displayed in a tabular format, or the track of a specific satellite pass can be plotted as a line on the star chart.

In order to be seen, a satellite pass has to satisfy several conditions:

First and most importantly, the satellite must rise above the observer's horizon. For satellites in low orbit, this generally means that the observer's latitude must be within the range of latitudes over which the satellite passes. A satellite will pass over (at some time or another) every point on the Earth's surface whose latitude is less than or equal to the satellite's orbital inclination. For example, a satellite with an orbital inclination of 30º can be seen from any latitude between roughly 30ºN and 30ºS, so it will never be visible for an observer at 50ºN. The higher the satellite's orbit, the greater is the distance outside its ground track from which it can be seen. The Ground Track menu command can be used to view the ground track of any satellite.

The satellite must be sunlit.

The observer must be in darkness, or at least twilight, so that the satellite is visible against a dark sky.

A pass of a satellite occurs whenever it rises above the observer's horizon; a "visible pass" occurs when all three of the above conditions are satisfied, so the sunlit satellite is seen against a dark sky - this will generally occur either shortly after sunset, or shortly before sunrise. In most cases, the satellite will rise in the west, cross the observer's meridian, and set in the east, although satellites in a polar orbit can rise or set in any part of the sky! Very often the satellite won't be visible for the whole of its passage across the sky, but will either emerge from or enter into the Earth's shadow while above the horizon.

Entering information

To predict satellite passes for the observation location set up on the current star chart, select the **Tools/Satellites/Pass Prediction...** menu item to display the first page of the Pass Prediction Dialog :

Pass Prediction

Select | Table

Name	Period
INTERCOSMOS 25	121
INTERCOSMOS 25 R/B	121
ISIS 1	128
ISS (ZARYA)	92
JERS-1	96
METEOR 1-1	96
METEOR 1-2	95
METEOR 1-2 R/B	89
METEOR 1-28 R/B	96
METEOR 1-4	95
METEOR 1-6 R/B	94
METEOR 1-7	95
METEOR 1-8 R/B	94
METEOR 1-9 R/B	94
METEOR PRIRODA	96
MIR	92
OAO 2	100
OAO 3 (COPERNICUS)	99
OKEAN 2 R/B	98
OKEAN 3	97
OPS 8180 (RADCAT)	97
ORBVIEW 2 (SEASTAR)	99
RESURS 01 R/B	99

Time

Start at midday on: 19 Jun 1999

Display positions every 15 seconds

Satellite selection

○ Show passes of the currently selected satellite
  for a period of 10 days

○ Show passes of all the satellites in the list
  for a period of 24 hours.

Options

☑ Show only visible passes
  (ie, passes during which the satellite is sunlit and the observer is in darkness)

☑ Show only passes with a minimum altitude
  of at least 10 °

OK | Cancel | Apply | Help

This page of the dialog allows you to enter all the information required by SkyMap to predict satellite passes. There are two basic types of prediction available, selected in the **Satellite Selection** section of the dialog:

You can predict all the passes of a specific satellite for a time period of several days or weeks. If you select this option, highlight the name of the satellite in the list at the left side of the dialog.

You can predict passes of all the satellites in the current data file for a single day. In this case, the selection in the list, if present, is ignored.

The **Time** section at the top of the dialog allows you to set time information for the pass. The standard date selector allows you to select the starting date for the pass predictions; the **Display positions every...** field allows you to set the frequency with which positions of the satellite are calculated during a pass; the smaller the time interval, the smoother will be the line on the star chart, at the expense of increased calculation time. For a satellite in low Earth orbit, the default time interval of 15 seconds will normally be acceptable, but for a geostationary satellite this should be increased to 60 seconds or more.

The **Options** section at the bottom of the dialog allows you to select several options for pass prediction:

The **Show only visible passes** check box allows you to select whether all passes of the satellite are displayed, or only visible passes. SkyMap defines a visible pass as one in which the satellite is sunlit, and the Sun at the observer's location is at least 6º below the horizon.

The **Show only passes with a minimum altitude** check box allows you to display only those passes during which the satellite reaches at least the specified minimum altitude above the observer's horizon.

Displaying a tabular list of passes

To display information about satellite passes in a tabular form, click the **Table** tab at the top of the dialog after entering all the required information on the **Select** page; the passes will be calculated (which may take a while on a slow computer) and the results will be displayed in the form of a table:

Visible passes of ISS (ZARYA) 19 Jun 1999 to 29 Jun 1999

Select | Table

Time	Alt	Az	Range	Rate	Vis
27 Jun 1999 00:07:00	44.5°	191.5°	545	0.416	
27 Jun 1999 00:09:00	17.9°	129.3°	1044	6.111	
ISS (ZARYA)					
27 Jun 1999 01:38:00	0.6°	276.5°	2262	-6.123	
27 Jun 1999 01:41:15	12.7°	242.8°	1272	-3.166	
ISS (ZARYA)					
27 Jun 1999 23:04:45	0.3°	272.3°	2294	-6.921	
27 Jun 1999 23:10:00	56.2°	189.1°	466	0.031	
27 Jun 1999 23:13:30	7.8°	109.4°	1575	6.805	
ISS (ZARYA)					
28 Jun 1999 00:40:45	0.1°	278.8°	2328	-6.568	
28 Jun 1999 00:45:45	23.4°	209.8°	871	-0.127	
ISS (ZARYA)					
28 Jun 1999 23:43:45	0.2°	278.1°	2312	-6.778	
28 Jun 1999 23:49:00	33.7°	198.3°	666	0.391	
28 Jun 1999 23:50:30	20.5°	150.5°	953	5.130	

Save... | Copy | Time: + | - | Display: ● Summary ○ Full

OK | Cancel | Apply | Help

For each pass, the table first displays the name of the satellite, and then shows one or more lines of information about that pass of the satellite. The information can be shown in two formats, selected by the **Summary** and **Full** buttons immediately below the table:

If the **Summary** display option is selected, information will be displayed only for the beginning of the pass, the time at which the satellite reaches its maximum altitude above the observer's horizon, and the end of the pass. This is generally the more useful option since it presents the most useful information in a compact manner. Note that the pass may either begin or end with the satellite above the horizon, and the time of maximum altitude may be coincident with the beginning or end of the pass, due to the satellite emerging from or entering into the Earth's shadow at that point.

If the **Full** display option is selected, information will be displayed for every calculated point during the pass; the time interval between these points will be the interval specified in the **Time** section of the **Select** page of the dialog. You will probably not often wish to display full details - a much better idea of the path taken by the satellite can be obtained by plotting its track on the star chart, as described below.

For each displayed point on the track, the following information is shown:

Time	The date and time at which the satellite is at this point on the pass. This is always displayed in the time zone set up for the current star chart.
Alt/Az	The altitude and azimuth of the satellite relative to the observer's horizon, measured in degrees.
Range	The distance of the satellite from the observer, in whatever units have been set up on the Satellite Configuration Dialog.
Rate	The rate at which the satellite is approaching (if negative) or receding from (if positive) the observer, again in the units specified on the Satellite Configuration Dialog .
Vis	The satellite's visibility. If the satellite is sunlit, this column will be blank. Values of "PEN" or "UMB" indicate that the satellite is in the Earth's penumbral or umbral shadows respectively. If only visible passes have been requested, this column will always be blank.

The **Save** and **Copy** buttons allow you to save the pass list to a text file or to copy it to the Windows clipboard respectively.

The **Time +** and **Time -** buttons repeat the pass calculation, moving the date either forward or backward. The date will move one day forward or backward if passes of all satellites are being predicted, or will move by whatever number of days is set up on the **Select** page of the dialog if passes for a single satellite are being predicted.

Displaying satellite tracks on the map

In addition to being able to display the times of satellite passes in a tabular format, SkyMap also allows you to plot the "track" of one or more satellite passes on the star chart, so you can see whereabouts in the sky the satellite will appear. To do this, exit the pass prediction dialog by clicking the **OK** button (if you wish to exit without plotting pass tracks on the star chart, exit by clicking the **Cancel** button); the Satellite Pass Plot Selection Dialog will be displayed:
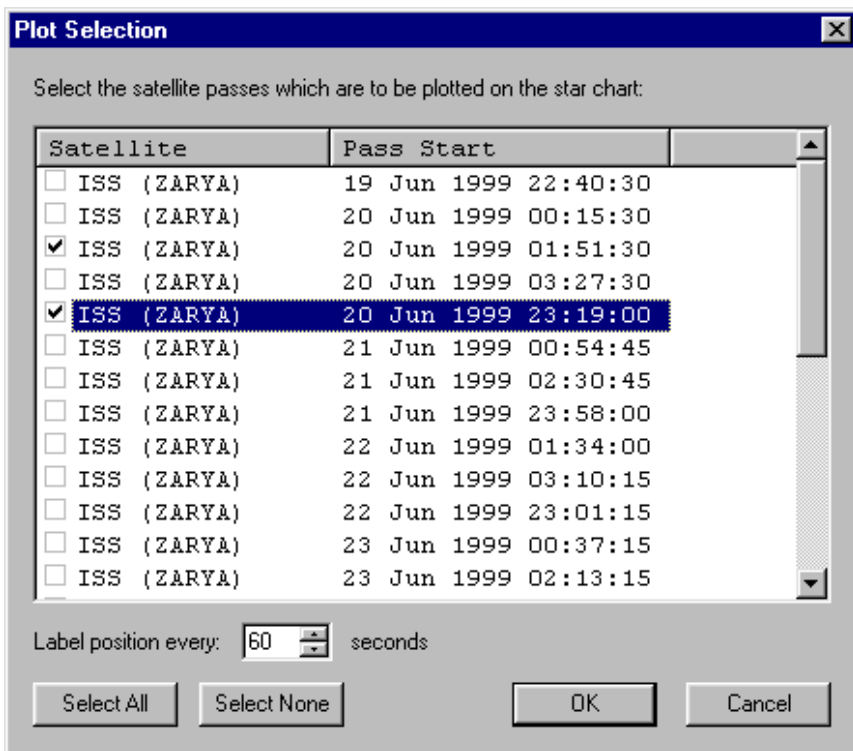
For each satellite pass, the dialog displays the name of the satellite and the date and time of the start of the pass; the list can be sorted in order of either name or time - as usual, click the column header to sort the list in order of that column, and click the column header a second time to reverse the sort order.

To select a pass for display on the star chart, check the box alongside that line in the list. Clicking the **Select All** button will select all passes in the list for display; clicking the **Select None** button will remove the check mark from every line in the list.

The **Label position every...** field below the list allows you to choose the time interval at which points on the satellite track will be labelled with the time. Only points for which a position can been calculated can be labelled, so this time interval should be an exact multiple of the calculation interval specified on the pass prediction dialog. If you don't want any time labels to appear on the track, enter a labeling interval of zero.

After selecting the passes to be displayed, exit the dialog by clicking the **OK** button; the satellite tracks will be displayed as lines on the star chart. The name of the satellite and the date of the start of the pass will be shown alongside the start of the track, while other points on the track will be labelled only with the time.

It's important to note that when satellite tracks are displayed on a star chart, what is shown is the path of the satellite relative to the *stars*. Since the chart will almost certainly *not* be showing the sky for the time of the predicted pass, the position of the satellite relative to the *horizon* (which is normally of much greater interest) will *not* be correct. Although you could manually change the map time to match that of the desired satellite track, we've provided a "short-cut" method of doing this. Simply position the mouse pointer over any point on the satellite track which is labelled with a time, click the right mouse button, and select **<satellite name> Track Time** from the resulting pop-up menu. The map time will be set to that of the point clicked on, and the satellite track will now be displayed correctly relative to the observer's horizon.

For example, when the above passes are initially shown on the star chart, we might see (on a "zenith" map view) the two tracks looking something like this:

This shows us the correct path of the satellite against the constellations, but doesn't show us the correct path relative to the horizon, because the map is not being displayed for the time of the satellite track. To display the "upper" of these two tracks correctly relative to the horizon, we position the mouse pointer over a time roughly in the middle of the track, right click, and select **Satellite Track Time**:

This results in the map being redrawn for the selected time, and we now see the track in the correct position relative to the horizon:

We can now clearly see that the satellite rises almost due west at 01:52, passes high overhead (travelling almost exactly midway between Altair and Vega), and sets slightly to the south of due east at 02:02.

We could now repeat this process to display the other satellite track on the map in its correct position relative to the horizon.

Removing tracks from the map

To remove satellite tracks from the map, select the **View/Clean Up Map** menu item.

Summary

We've now covered the basic operation of SkyMap, and you should be in a good position to carry on "exploring" by yourself. The on-line help system describes what the program can do, but don't forget that all the "in depth" help on individual dialogs and menu items is in the "context sensitive" help. To get detailed information about a dialog, press the **F1** key while the dialog is visible on the screen; to get detailed

information about a menu item or toolbar button, click the [?] toolbar button and then click the menu item or button you require help on.

We hope that you enjoy using SkyMap. Don't forget that information about the program, together with lots of "extras" to enhance it are available from the SkyMap Software web site at http://www.skymap.com

Appendices

The Greek alphabet

The bright stars in each constellation are labelled with Greek letters. The Greek alphabet is as follows:

Letter	Name
?, ?	Alpha
?, ?	Beta
?, ?	Gamma
?, ?	Delta
?, ?	Epsilon
?, ?	Zeta
?, ?	Eta
?, ?	Theta
?, ?	Iota
?, ?	Kappa
?, ?	Lambda
?, ?	Mu
?, ?	Nu
?, ?	Xi
?, ?	Omicron
?, ?	Pi

? , ?	Rho
? , ?	Sigma
?, ?	Tau
? , ?	Upsilon
?, ?	Phi
? , ?	Chi
? , ?	Psi
? , ?	Omega

The first column gives the lower-case and upper-case forms of each letter; the second column the "name" of the letter.

Constellation names and abbreviations

The following table lists the names of the 88 constellations. For each constellation, the following information is given:

Name

The full Latin name of the constellation

Genitive

The "genitive" form of the constellation name, used when referring to stars in that constellation. For example, the brightest star in the constellation of Taurus is called ? Tauri, since "Tauri" is the genitive form of "Taurus".

IAU abbreviation

The standard 3-letter abbreviation for the constellation.

English name

The common English name of the constellation.

Name	Genitive	Abbrev	English Name
Andromeda	Andromedae	And	Andromeda
Antlia	Antliae	Ant	The Air Pump
Apus	Apodis	Aps	The Bird of Paradise
Aquarius	Aquarii	Aqr	The Water Carrier
Aquila	Aquilae	Aql	The Eagle
Ara	Arae	Ara	The Altar

Aries	Arietis	Ari	The Ram
Auriga	Aurigae	Aur	The Charioteer
Boötes	Boötis	Boo	The Herdsman
Caelum	Caeli	Cae	The Chisel
Camelopardalis	Camelopardalis	Cam	The Giraffe
Cancer	Cancri	Cnc	The Crab
Canes Venatici	Canum Venaticorum	CVn	The Hunting Dogs
Canis Major	Canis Majoris	CMa	The Greater Dog
Canis Minor	Canis Minoris	CMi	The Lesser Dog
Capricornus	Capricorni	Cap	The Sea Goat
Carina	Carinae	Car	The Keel
Cassiopeia	Cassiopeiae	Cas	Cassiopeia
Centaurus	Centauri	Cen	The Centaur
Cepheus	Cephei	Cep	Cepheus
Cetus	Ceti	Cet	The Whale
Chamaeleon	Chamaeleontis	Cha	The Chameleon
Circinus	Circini	Cir	The Compasses
Columba	Columbae	Col	The Dove
Coma Berenices	Comae Berenices	Com	Berenice's Hair
Corona Australis	Coronae Australis	CrA	The Southern Crown
Corona Borealis	Coronae Borealis	CrB	The Northern Crown

Corvus	Corvi	Crv	The Crow
Crater	Crateris	Crt	The Cup
Crux	Crucis	Cru	The Southern Cross
Cygnus	Cygni	Cyg	The Swan
Delphinus	Delphini	Del	The Dolphin
Dorado	Doradus	Dor	The Goldfish
Draco	Draconis	Dra	The Dragon
Equuleus	Equulei	Equ	The Little Horse
Eridanus	Eridani	Eri	The River
Fornax	Fornacis	For	The Furnace
Gemini	Geninorum	Gem	The Twins
Grus	Gruis	Gru	The Crane
Hercules	Herculis	Her	Hercules
Horologium	Horologii	Hor	The Pendulum Clock
Hydra	Hyrdae	Hya	The Water Snake
Hydrus	Hydri	Hyi	The Lesser Water Snake
Indus	Indi	Ind	The Indian
Lacerta	Lacertae	Lac	The Lizard
Leo	Leonis	Leo	The Lion
Leo Minor	Leonis Minoris	LMi	The Lesser Lion
Lepus	Leporis	Lep	The Hare

Libra	Librae	Lib	The Scales
Lupus	Lupi	Lup	The Wolf
Lynx	Lyncis	Lyn	The Lynx
Lyra	Lyrae	Lyr	The Lyre
Mensa	Mensae	Men	The Table
Microscopium	Microscopii	Mic	The Microscope
Monoceros	Monocerotis	Mon	The Unicorn
Musca	Muscae	Mus	The Fly
Norma	Normae	Nor	The Level
Octans	Octantis	Oct	The Octant
Ophiuchus	Ophiuchi	Oph	The Serpent Holder
Orion	Orionis	Ori	The Hunter
Pavo	Pavonis	Pav	The Peacock
Pegasus	Pegasi	Peg	The Winged Horse
Perseus	Persei	Per	Perseus
Phoenix	Phoenicis	Phe	The Phoenix
Pictor	Pictoris	Pic	The Painter's Easel
Pisces	Piscium	Psc	The Fishes
Piscis Austrinus	Piscis Austrini	PsA	The Southern Fish
Puppis	Puppis	Pup	The Stern
Pyxis	Pyxidis	Pyx	The Compass
Reticulum	Reticuli	Ret	The Net

Sagitta	Sagittae	Sge	The Arrow
Sagittarius	Sagittarii	Sgr	The Archer
Scorpius	Scorpii	Sco	The Scorpion
Sculptor	Sculptoris	Scl	The Sculptor
Scutum	Scuti	Sct	The Shield
Serpens	Serpentis	Ser	The Serpent
Sextans	Sextantis	Sex	The Sextant
Taurus	Tauri	Tau	The Bull
Telescopium	Telescopii	Tel	The Telescope
Triangulum	Trianguli	Tri	The Triangle
Triangulum Australe	Trianguli Australis	TrA	The Southern Triangle
Tucana	Tucanae	Tuc	The Toucan
Ursa Major	Ursae Majoris	UMa	The Great Bear
Ursa Minor	Ursae Minoris	UMi	The Little Bear
Vela	Velorum	Vel	The Sails
Virgo	Virginis	Vir	The Virgin
Volans	Volantis	Vol	The Flying Fish
Vulpecula	Vulpeculae	Vul	The Fox

Glossary of astronomical terms

Aberration

A very small change (a maximum of 20 seconds of arc) in the apparent position of a star or other **deep sky object**, caused by the fact that the speed of the Earth as it orbits the Sun is a measurable fraction of the speed of light. The discovery of aberration was the first direct "observational proof" that the Earth orbits the Sun.

Albedo

The fraction of the light hitting an object which is reflected back from it. The higher the albedo, the more "reflective" the object.

Altitude

The angular distance of an object above the horizon. The altitude of an object is 0° when it's on the horizon, and 90° when it's directly overhead.

Alt/Az mount

A type of telescope mount in which one axis of the telescope moves it in altitude, and the other axis moves it in azimuth. The popular **Dobsonian** mount is an alt/az mount.

Aperture

The diameter of the primary lens or mirror of a telescope, normally expressed in inches or mm.

Aphelion

The position in a solar orbit which is most distant from the Sun. Also used to describe the time at which an object in solar orbit (eg a planet or comet) reaches that point in its orbit.

Arc minute

A unit of "angular measurement" equal to 1/60th of a degree. The Moon is roughly half a degree, or 30 arc minutes, in size. An arc minute is subdivided into 60 **arc seconds**. The symbol for arc minutes is ', eg 30'.

Arc second

A unit of "angular measure" equal to 1/60th of an **arc minute**, or 1/3600th of a degree. The symbol for arc seconds is ", eg 15".

Asteroid

A small rocky body orbiting the Sun in much the same way that planets do. Most asteroids orbit the Sun between Mars and Jupiter, in the so-called "asteroid belt". The orbits of some 20,000 asteroids are currently known. The largest asteroid, Ceres, has a diameter of just over 1000 km. Asteroids are sometimes called **minor planets**.

Astronomical unit (AU)

The mean distance between the Sun and the Earth, equal to 149.6 million kilometres, or 92.96 million miles. Distances of objects in the solar system are normally given in AU.

Azimuth

The angular distance of an object measured clockwise around the horizon from a specified reference point. The "reference point" which forms the "zero" of the azimuth scale can be either due north or due south. SkyMap always measures azimuth from due north, so it is identical to the more familiar concept of "compass bearing".

Celestial equator

The "projection" of the Earth's equator onto the **celestial sphere**. The equator is a plane at right angle to the **celestial poles**.

Celestial poles

The two points where the "projection" of the Earth's axis of rotation meet the **celestial sphere**. As the Earth rotates, the sky appears, to an observer on the Earth's surface, to rotate around the two "fixed" **celestial poles**.

Celestial sphere

An imaginary sphere upon which all objects in the sky may be considered to be located.

Comet

A small icy object orbiting the Sun, often in a very highly elliptical orbit which takes it very close to the Sun at one end of its orbit, and very far away from the Sun at the other end of its orbit. When a comet is near the Sun, its icy surface is heated and evaporates, producing the characteristic "tail" of gas and dust which is illuminated by the Sun. A comet with an orbital **period** of less than 200 years is called a "periodic comet", of which the best known is probably Halley's comet, which orbits the Sun every 76 years.

Constellation

An area of the sky, usually with mythological associations. The celestial sphere is precisely divided into 88 constellations, so that every point in the sky is in exactly one constellation.

Declination

The angular distance of an object north or south of the **celestial equator**. Declination forms one of the two components of the **equatorial coordinate system**, the other being **right ascension**.

Deep sky object

A general term used to refer to any object outside the solar system which is not a star. Deep sky objects include **galaxies**, **open clusters**, **globular clusters**, **nebulae**, and so on.

Delta T

The difference between **dynamical time** and **universal time**. Delta T is used to convert "clock time" (UT) into the uniform time scale of "dynamical time" which is used for such things as computing planetary positions. Delta T can only be measured "after the fact", since it depends on the Earth's irregular rate of rotation.

Dobsonian mount

A very cheap and effective method of mounting telescopes, invented by John Dobson, and now extremely popular, especially for cheaper telescopes. A Dobsonian mount consists of a flat "base plate" which sits on the ground and allows the telescope to

rotate in azimuth, on top of which is a "rocker box" in which the telescope tube is pivoted, allowing the telescope to move in azimuth.

Double star

A star which, when looked at through a telescope, can be "split" into two or more separate stars. Most double star systems are physical groupings of stars which orbit one another, although a few a chance pairings of physically distant stars which simply lie in the same "light of sight" to us.

Dynamical time

The independent time scale which forms the basis of the theories from which planetary positions are computed. Dynamical time does not depend on the Earth's irregular rotation rate. The difference between dynamical time and **universal time** is called "Delta T".

Eccentricity

A number defining how "elongated" an elliptical orbit is. An orbit with an eccentricity of zero is a perfect circle; as the eccentricity increases towards 1, the orbit becomes more and more "stretched" until at a eccentricity of exactly 1.0 it becomes a parabola - an "open" orbit. In the set of orbital elements for a comet or asteroid, the eccentricity is defined by the value **e**.

Ecliptic

The apparent path of the Sun against the stars over the course of a year. The ecliptic marks the "plane" of the Earth's orbit, and is inclined to the **celestial equator** by roughly 23.5°. All the major planets are always within a few degrees north or south of the line of the ecliptic. The **constellations** through which the ecliptic passes are called the **zodiac**.

Elongation

The angular separation between an object and the Sun.

Epoch

A fixed instant of time used as a "reference point" for such things as celestial coordinate systems or orbital elements.

Equatorial coordinates

The coordinates of an object, specified by **right ascension** and **declination**. The equatorial coordinates of a "fixed" object (eg a star) do not change as the earth rotates. The position of an astronomical body is nearly always given in equatorial coordinates. The equatorial coordinate system slowly rotates, relative to the stars, taking roughly 25,760 years for a complete rotation. For precise coordinates, it is therefore necessary to give the **epoch** of the coordinate system; this will normally be either the "epoch of date", or the fixed epoch "J2000.0".

Equatorial mount

A method of mounting a telescope such that one of the telescope's axes is parallel with the Earth's axis of rotation. This allows the telescope to track the stars as the earth rotates simply by rotating around that one axis.

Equinox

One of the two points at which the **ecliptic** intersects the **celestial equator**. One of these two points is the "zero point" for the right ascension coordinate scale.

Focal length

The distance from a lens or mirror at which light comes to a focus. Normally expressed in inches, cm, or mm.

Focal ratio

The ratio of the focal length of a lens or mirror compared with its diameter. Normally written f/10 or f/6.3. Telescopes with low focal ratios (around f/6 or lower) are called "fast" telescopes, and offer wide fields of view with low magnifications - ideal for observing **deep sky objects**. Telescopes with high focal ratios offer high magnifications and small fields of view, and are better suited for observing planets.

Galactic cluster

See **open cluster**.

Galaxy

A system "external" to our own galaxy, very distant and containing many billions of stars. Galaxies come in many shapes and sizes - spirals, "barred" spirals (in which the spiral arms come from the ends of a "bar" through the centre of the galaxy), elliptical (which have no spiral arms), and irregular (which have no particular shape at all).

Geocentric coordinates

The position of an object as it would theoretically be seen from the centre of the Earth.

Globular cluster

A globular cluster is a roughly spherical star cluster, containing anything up to a few million stars, which orbits outside the disk of the galaxy. Globular clusters are very old and form a spherical "shell" which surrounds the galaxy.

Hour angle

The angular distance between a celestial object and the observer's local **meridian**. Mathematically, hour angle is equal to the difference between the object's **right ascension** and the observer's **sidereal time**. The hour angle of an object is zero when the object is on the merdian.

Hour circle

A line drawn between the two **celestial poles** passing through the position of an object and crossing the **celestial equator** at a right angle.

Inclination

A value measuring the "tilt" of the orbit of an object relative to the Earth's orbit. An object with an inclination of 0° orbits the Sun in the same "plane" as the Earth, whilst an orbital inclination of 90° indicates an orbit at "right angles" to that of the Earth. Some comets have orbital inclinations greater than 90°, which means they are orbiting the Sun in the "opposite direction" to that of the Earth and all the other major planets. In the set of orbital elements for an asteroid of comet, the inclination is defined by the value "**i**".

International Astronomical Union (IAU)

The international organization which is the "ruling body" for astronomy world wide. The IAU has sole responsibility for officially naming objects, defining coordinate systems, and so on.

Julian day number (JD)

A sequential count of days since Greenwich noon on January 1st, 4713 BC. Many astronomical calculations are carried out with the Julian day number as their time basis.

Light year

The distance travelled by light in a vacuum over the course of a year, equal to approximately 63,200 **astronomical units** or 9,500 billion km. The distances of stars are normally measured in light years.

Magnitude

A logarithmic brightness scale used to measure the brightness of celestial objects - the higher the number, the fainter the object. The brightest stars in the sky are roughly magnitude 1; the faintest stars visible to the naked eye from a dark location are roughly magnitude 6.5. A change of 5 magnitudes corresponds to a change of a factor of 100 in the brightness of an object.

Meridian

The vertical plane passing over the observer's head and intersecting the observer' local horizon in a directly north-south direction. As the Earth rotates, objects reach their highest (and lowest) altitude as the cross over the observer's meridian. The local **sidereal time** is equal to the **right ascension** currently crossing the meridian.

Minor planet

See **asteroid**.

Nadir

The point directly beneath an observer - ie the point which has an altitude of -90°.

Nebula

A cloud of gas and dust. Nebulae may be either "bright", in which case they are illuminated by stars either embedded within them, or close to them (eg the Orion nebula), or they may be "dark" in which case they are seen as "holes" silhouetted

against the background of the milky way (eg the "Coal Sack") or a more distant bright nebula (eg the "Horsehead Nebula").

Nova

A nova occurs when a star temporarily increases its brightness by many magnitudes, and then slowly fades back to its previous relative obscurity. The physical nature of a nova is a binary star system with one "white dwarf" star and one "normal" star in close proximity. Gas from the normal star slowly accumulates on the surface of the dwarf star and its temperature and pressure increase. When they reach critical values, a thermonuclear explosion "blasts" the gas off the surface of the star, forming am expanding "shell" around the star system, and the whole process may begin again.

Open cluster

A loose, gravitationally bound, association of stars within the galaxy. Also known as **galactic clusters**. The Pleiades is probably the best known open cluster.

Orbit

The path "traced out" by an object, such as an asteroid or comet, as it travels around the Sun. The orbit of all such objects is, to a close approximation, an ellipse with the Sun at one "focus".

Orbital elements

A set of numbers which mathematically describe the **orbit** of an asteroid or comet. The orbital elements allow the position of the asteroid or comet to be calculated for any desired time.

Parallax

The difference in the apparent direction of a nearby object when viewed from different locations. Parallax causes slight differences in the coordinates of objects in the solar system as seen from different locations on the Earth's surface. The parallax of a star is the apparent change in its position against more distant "background stars" caused the the Earth's motion around the Sun, and forms the method used to directly measure the distance of nearby stars (within a few hundred **light years**).

Parsec (pc)

The distance from which one **astronomical unit** subtends an angle of one arc second. Equal to 3.26 **light years** or 206,265 astronomical units. The distances of galaxies are often quoted in "megaparsecs" (Mpc).

Perihelion

The position, in an orbit around the Sun, which is closest to the Sun. Also used to describe the time at which an object in solar orbit (such as a planet or a comet) reaches that position in its orbit. In the set of orbital elements for a comet, this time is specified by the element "**T**".

Perihelion distance

The distance of an object from the Sun when it is at **perihelion**, normally measured in **astronomical units**. In the set of orbital elements for a comet, perihelion distance is specified by the element "**q**".

Period

1) The amount of time taken for an object to complete an orbit, 2) the length of time between recurrences of a periodic phenomenom (e.g., between two successive "maxima" of a variable star).

Phase

The percentage of the apparent disk of a celestial body which is currently sunlit.

Phase angle

The angular separation between the Sun and the Earth as seen from a body in the solar system. This is mathematically related to the object's **phase** as seen from the Earth. Phase angle is always between 0° and 180°.

Planetary nebula

A planetary nebula is an old star, similar in size to the Sun, which has "thrown off" one or more "shells" of gas. The Ring Nebula, M57, is one of the best examples of a planetary nebula.

Precession

The slow rotation of the **celestial poles** in a 23.5° circle centred on the ecliptic poles, a complete rotation taking 25,760 years. The effect of precession is to slowly change

the positions of the celestial poles against the stars, and also to slowly change the **equatorial coordinates** of a "fixed" object such as a star or galaxy.

Proper motion

The rate of change in the position of a star due to the physical motion of the star through space.

Quasar

A quasar is a very compact and very distant object, believed to be the highly energetic "core" of a distant galaxy.

Radius vector

The distance of a solar system object from the Sun. Normally measured in **astronomical units**.

Refraction

A small increase in the apparent altitude of a celestial object caused by the light from it being "bent" by the Earth's atmosphere. The effect of refraction is greatest at the horizon, and decreases rapidly with altitude. Refraction is affected to a small degree by both the air temperature and the atmospheric pressure.

Refractor

A type of telescope whose main means of forming the image is a lens at the front - ie a traditional "spy-glass" type of telescope.

Reflector

A type of telescope whose main means of forming the image is a mirror at the "back" of the telescope tube. Most astronomical telescopes are reflectors, due to the fact that for a given size of mirror, a reflector is very much cheaper than a **refractor**.

Right ascension

The angular distance on the **celestial sphere** measured eastwards along the **celestial equator** from the **equinox** to the **hour circle** passing through the celestial object whose position is being measured. Right ascension forms one of the two "components" of the **equatorial coordinate system**, the other being **declination**.

Schmidt-Cassegrain (SCT)

A popular design of telescope combining features of both the **refractor** and the **reflector**. A Schmidt-Cassegrain (SCT) telescope has a glass "corrector plate" at the front of the tube with a small secondary mirror in the centre. The primary mirror is at the back of the tube, and the image is observed through a hole in the centre of the primary mirror. SCT's have very short tubes compared to reflectors or refractors and so are extremely portable.

Semi-major axis

Half the length of the "long axis" of an elliptical orbit, normally measured in **astronomical units**. For a comet or asteroid, the semi-major axis defines the mean distance of the object from the Sun. In the list of orbital elements for an asteroid, the semi-major axis is defined by the value "**a**".

Sidereal day

The period of the Earth's rotation relative to the stars, ie the interval between two successive **transits** of the same star. Equal to approximately 23h 56m 4s.

Sidereal time

A measurement of time defined by the apparent motion of the stars as the earth rotates. The sidereal time is zero when the **equinox** crosses the observer's **meridian**. An object is on the observer's meridian (ie due south or due north) when the local sidereal time is equal to the object's **right ascension**.

Star

A ball of gas emitting light due to nuclear reactions in its core. Our Sun is a typical star. The smallest known stars are about 1/50th the mass of the Sun, and the largest about 20x the mass of the Sun. The closest star system to us (other than the Sun) is the ? Centauri system - a triple star system about 4.3 **light years** from us.

Sunrise

The instant at which the top of the rising Sun's disk first appears above the observer' horizon.

Sunset

The instant at which the top of the setting Sun's disk disappears below the observer's horizon.

Supernova

One possible "end" to the life of a star considerably more massive than the Sun, in which the star literally "blows itself to pieces", temporarily becoming as bright as an entire galaxy, and then slowly fading away over the course of several months. A typical galaxy has 2-3 supernova explosions every century although (much to the annoyance of astronomers) no supernova has been observed in <u>our</u> galaxy since the invention of the telescope!

Supernova remnant

A gaseous "shell" which is all that remains of a massive star which has "exploded" at the end of its life. The Crab Nebula, M1, is an example of this type of object.

Terminator

The line separating the sunlit and "dark" areas of the apparent disk of the Moon or other object in the solar system.

Topocentric coordinates

The coordinates of an object seen from the location of an observer on the Earth's surface. For solar system bodies, this can differ markedly from the object's **geocentric coordinates** due to the effect of **parallax**.

Transit

The time at which an object crosses the observer's **meridian**, ie is due south or due north.

Twilight

The time preceding **sunrise** and following **sunset** during which the sky is partially illuminated by the rising or setting Sun.

UT (Universal Time)

A system of time measurement which conforms to the mean motion of the Sun, and which forms the basis for "civil" timekeeping. UT is defined by a mathematical formula which related it to **sidereal time**; ie UT is determined from measurements of the positions of the stars as the Earth rotates.

UTC (Coordinated Universal Time)

The time scale available from broadcast time signals; basically the successor to Greenwich Mean Time (GMT). UTC is maintained within 1 second of **UT** by the occasional introduction of "leap seconds".

Variable star

A star whose brightness varies with time. Some variable stars change their brightness due to changes in their physical nature (eg "pulsing" in and out, as Cepheid variables do), whilst others change their brightness due to eclipses of unseen companion stars.

Zenith

The point directly over an observer's head - ie the point which has an altitude of 90°.

Zodiac

The **constellations** through which the line of the **ecliptic** passes.

Obtaining support

Before obtaining support with SkyMap, please have the exact version number of the program available. This version number is displayed on the dialog box shown by the **Help/About SkyMap...** menu item. It will have the form "8.0.x", where "x" is a number.

Your first line of contact for support should always be the company from whom you bought SkyMap; they will be able to sort out almost all problems immediately over the telephone. If you have a particularly "thorny" problem, or you wish to ask a question related to the "technical" side of astronomy, rather than something computer-related, please feel free to contact us directly.

Note that most SkyMap "bugs" are caused by faulty video drivers. If you experience problems such as crashes or the machine "locking up", the first thing to try is switching your machine to use a video mode of 640x480 in 16 colours. This will make the machine use the standard VGA driver, which is pretty much bug-free. If you find that SkyMap works correctly in this video mode (as it almost certainly will), you'll need to obtain updated video drivers from the supplier of your video card or computer. SkyMap Software can obviously not be held responsible for bugs in video drivers - this is totally outside our control!

Obtaining support from the SkyMap mailing list

There is a mailing list for all users of SkyMap at http://www.yahoogroups.com. The name of the mailing list is "skymap" and it is free to join and use. The SkyMap web site at http://www.skymap.com has a link to the "joining" page of the mailing list on its home page. The mailing list is the ideal way to communicate with other SkyMap users, and we would strongly encourage all SkyMap users to join it.

Obtaining support by electronic mail

To obtain support by e-mail, please send a message to "support@skymap.com". We will do our best to answer any e-mail message within 24 hours of receipt.

Obtaining support by telephone, fax, or post

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