Chris Marriott's

SkyMap Pro 11

www.skymap.com

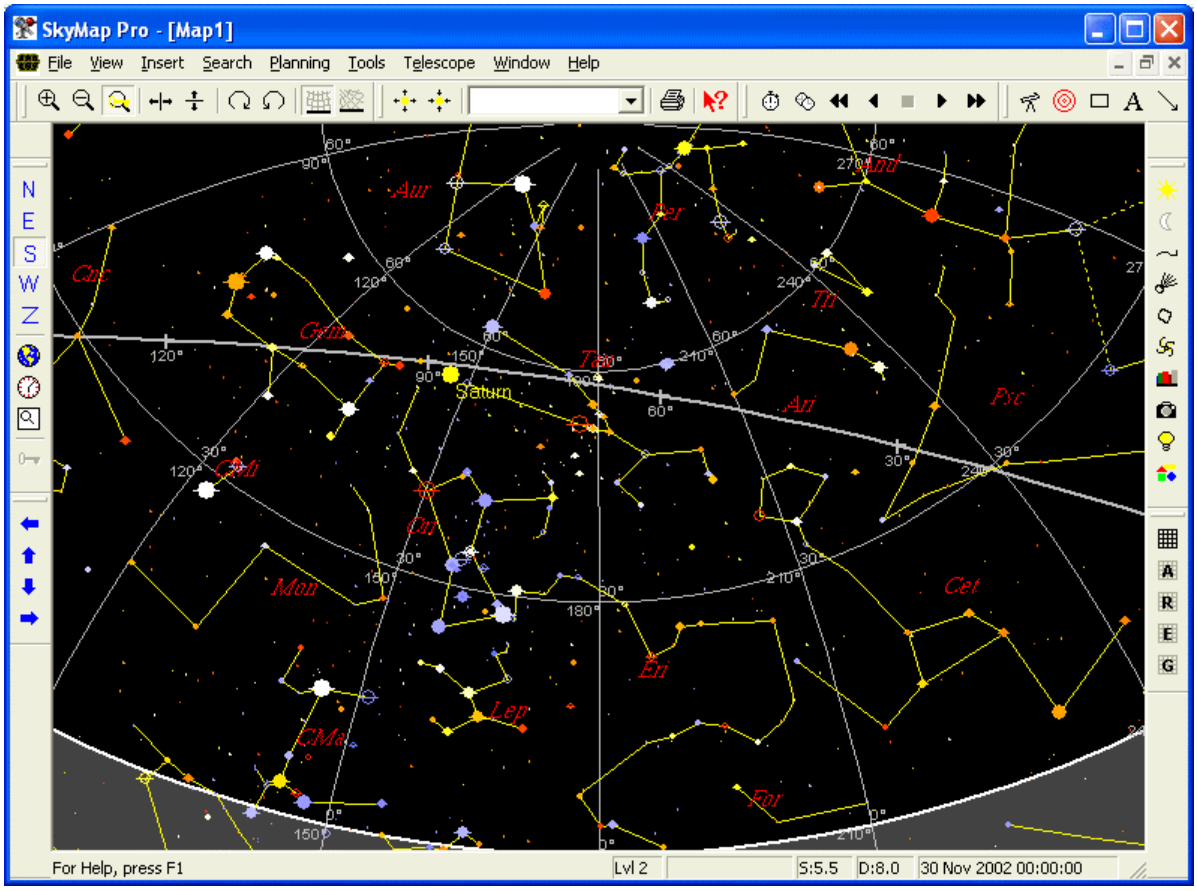
Software for Astronomers

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 (if you've selected the "complete" installation option, this is not necessary), and then run it by either double-clicking the "SkyMap Pro 11" icon on the Windows desktop, or by going to the **Start** menu on the Windows task bar, and selecting the **Programs/SkyMap Pro 11/SkyMap Pro 11** 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 grey 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 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.

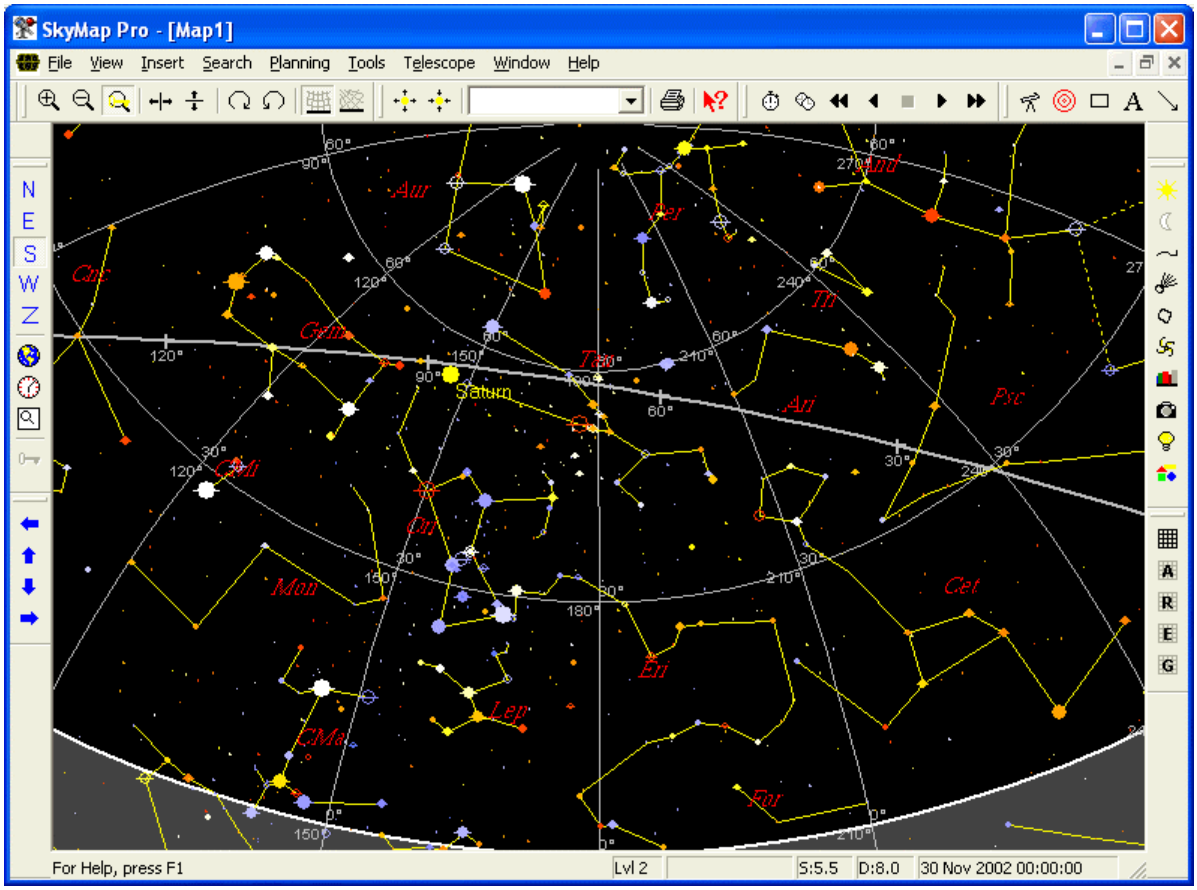
Finally, along the very bottom of the map window is a "status bar" displaying current information about the map. Two items of particular interest are "S 5.5" - indicating that the faintest star currently visible on the map is magnitude 5.5 - and the panel to the right of that which shows the date and 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!

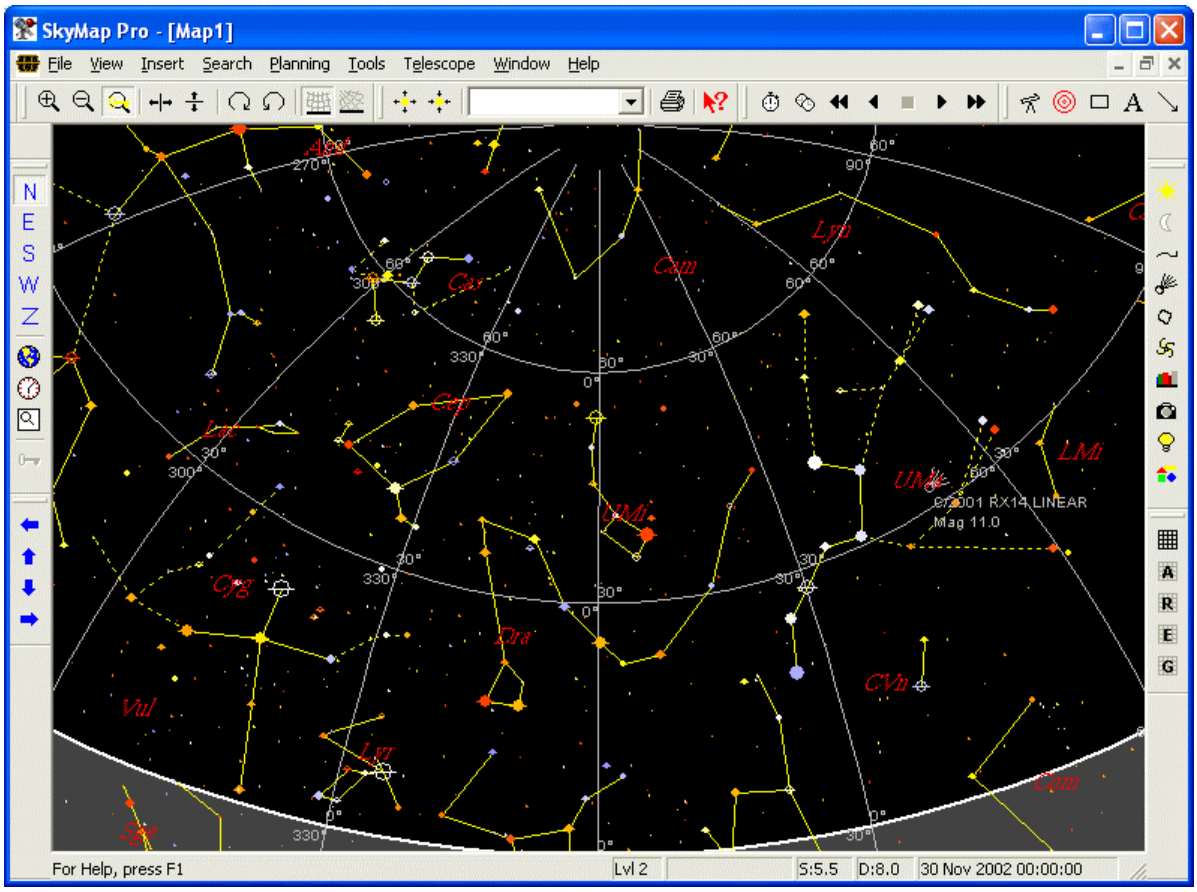
Displaying the standard map views

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.

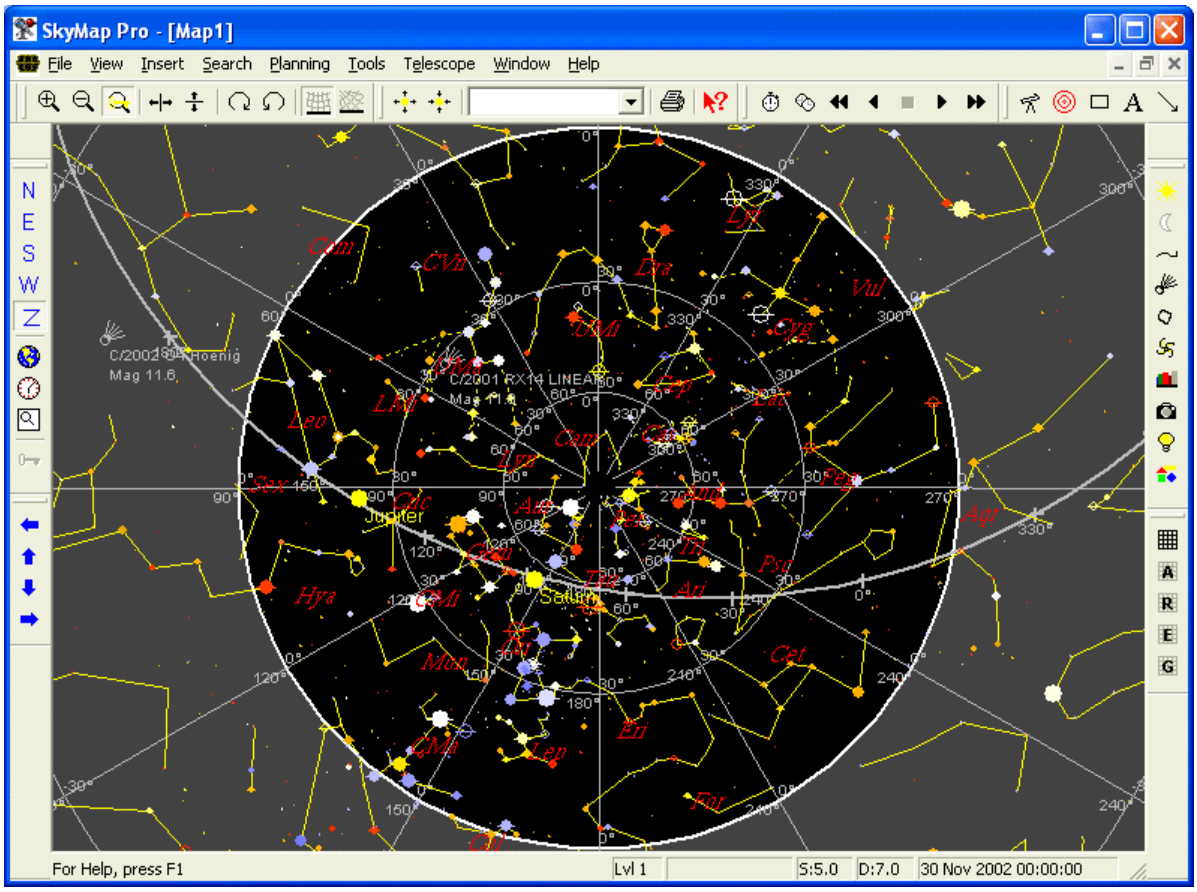
Click the **N** button; the map will change to show a view of the northern horizon:



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.

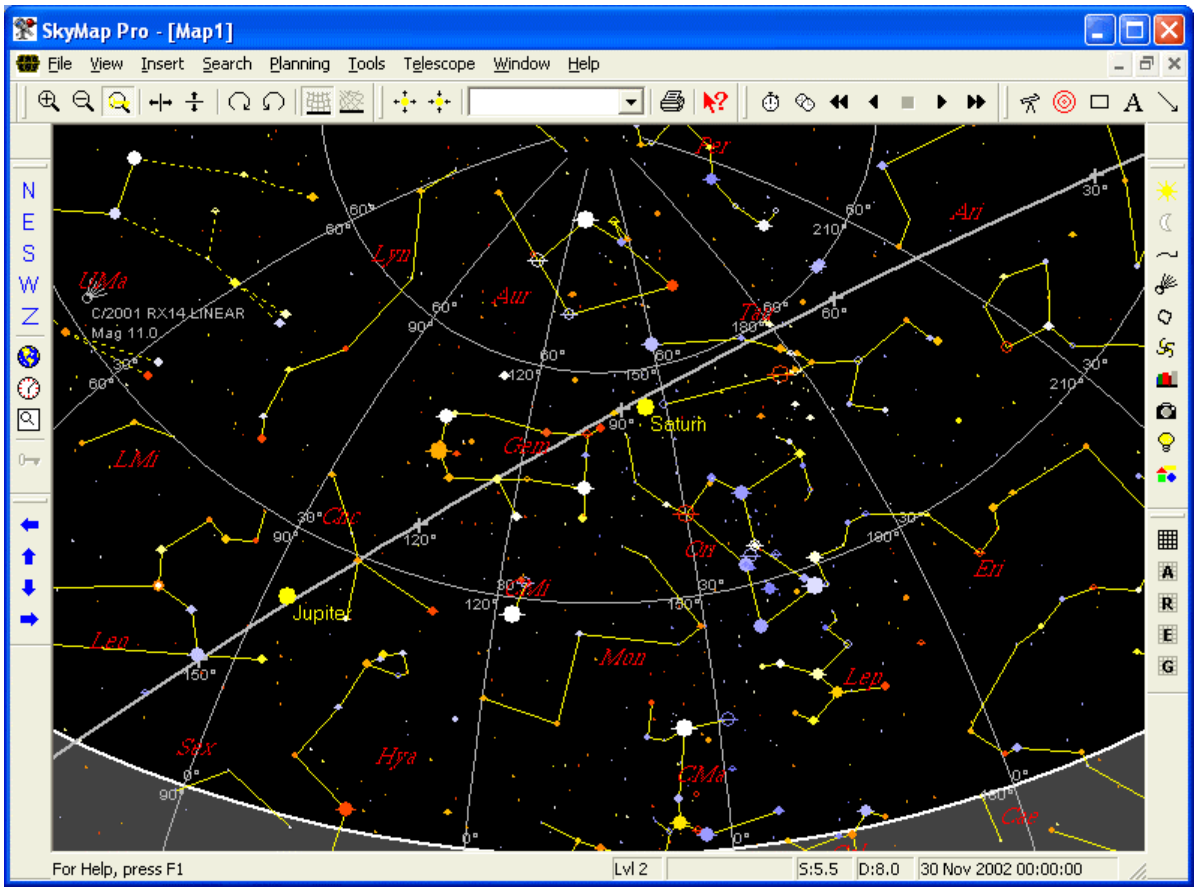
Finally, press the **S** key to return to the initial southern horizon view.

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 w ill 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.

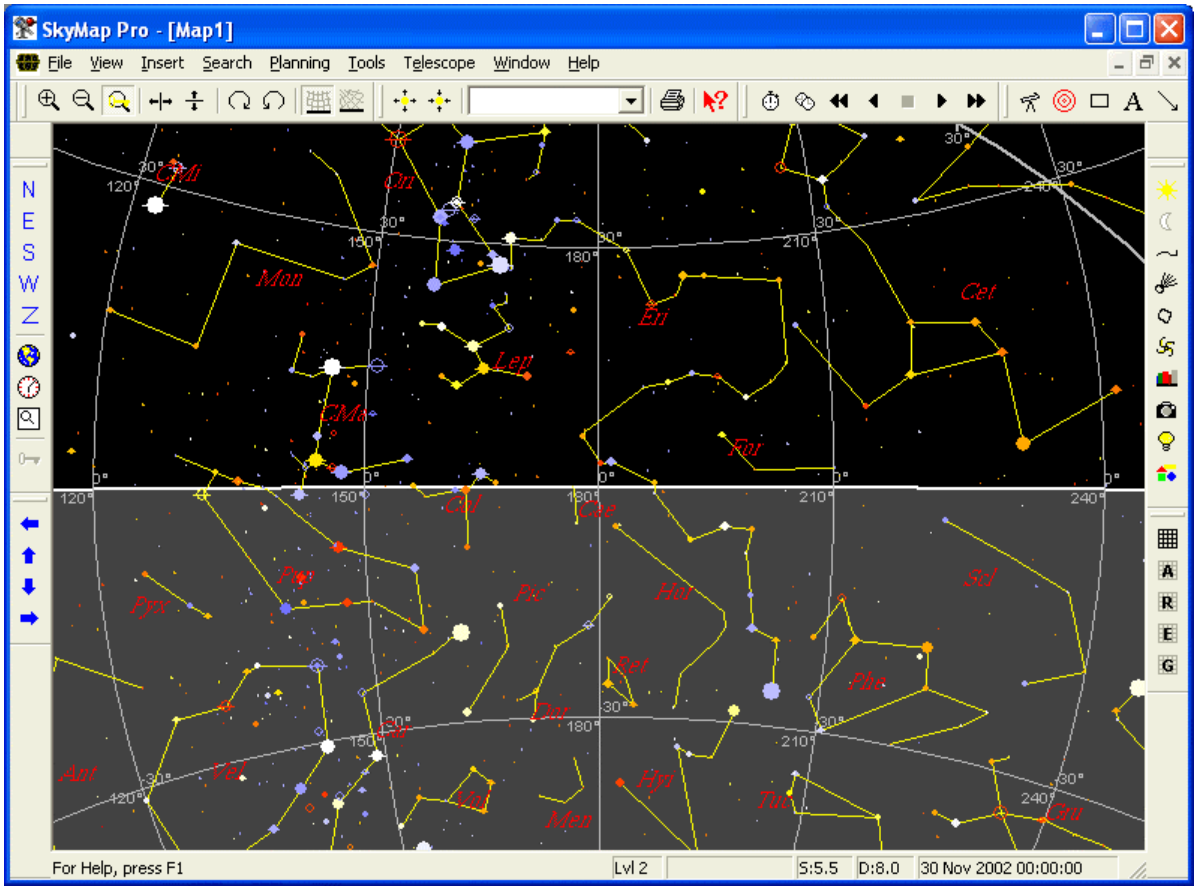
Next, try pressing the *right* arrow key on the keyboard (or clicking the  toolbar button). This time (as I'm sure you've already guessed) the map will move to the *left*, showing new parts of the sky at the right side of the map. Pressing the right arrow key is like turning your head to the right; each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

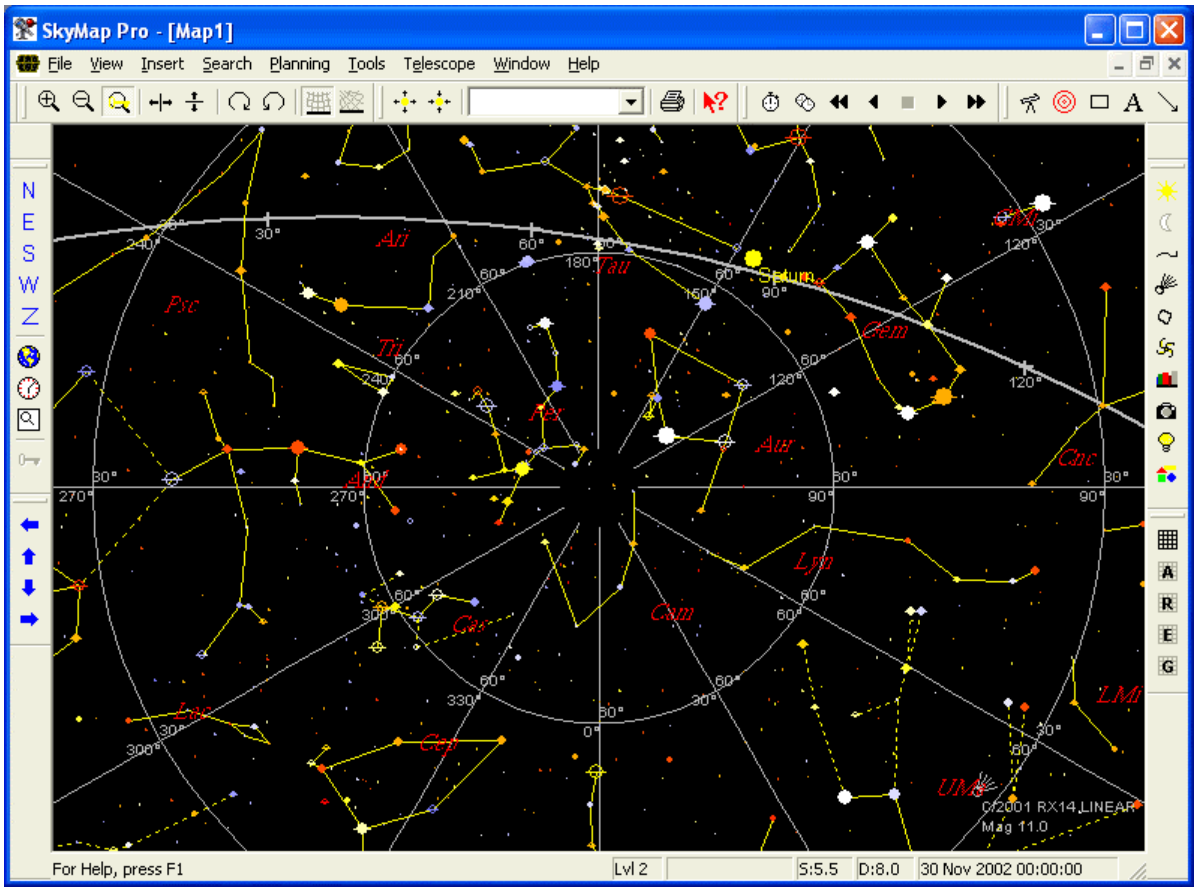
Press the **S** button to return to our standard starting point of the southern horizon view, and then press the down arrow key three times (or click the  button), waiting for the map to be redrawn after each key press. Each time

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 lower half of the map shows sky which is *not* visible to us. Remember that the grey-shaded part of the map represents the portion of the sky below the horizon.

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 w ish. 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

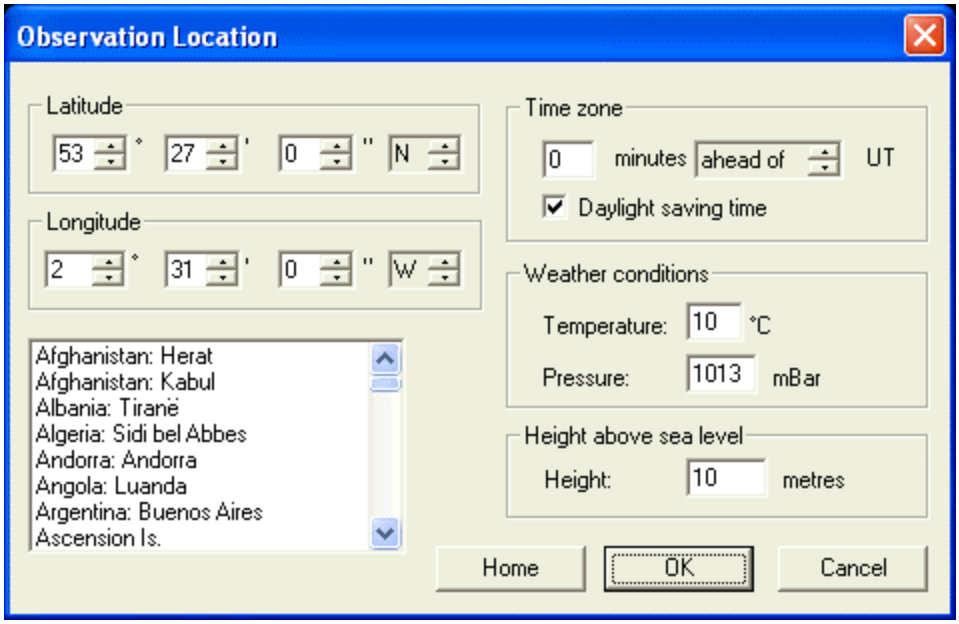
If it's not already running, start SkyMap and switch to the standard southern horizon view as we've learned in previous lessons.

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  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.

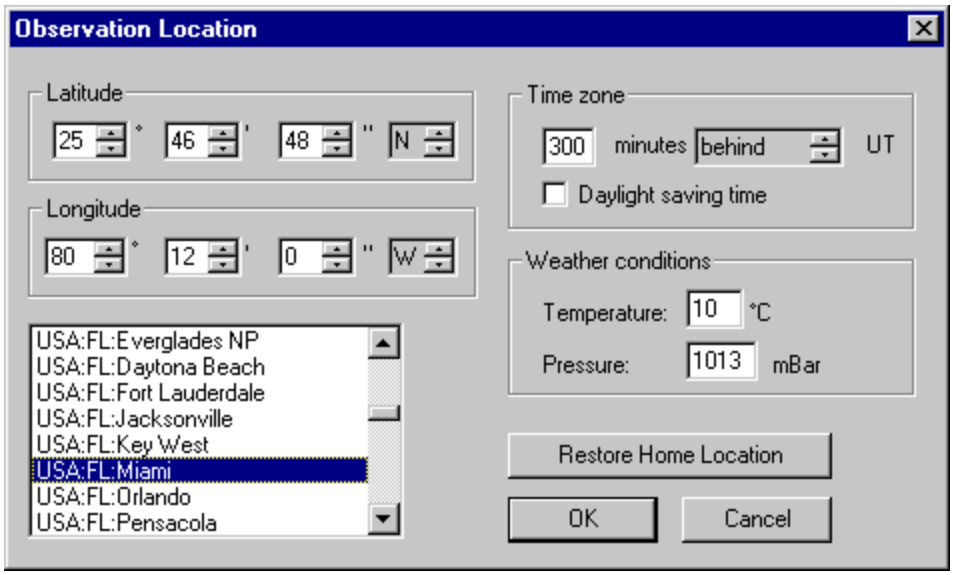
?? Your longitude - how far east or west of the "Greenwich Meridian" you live.

?? 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.

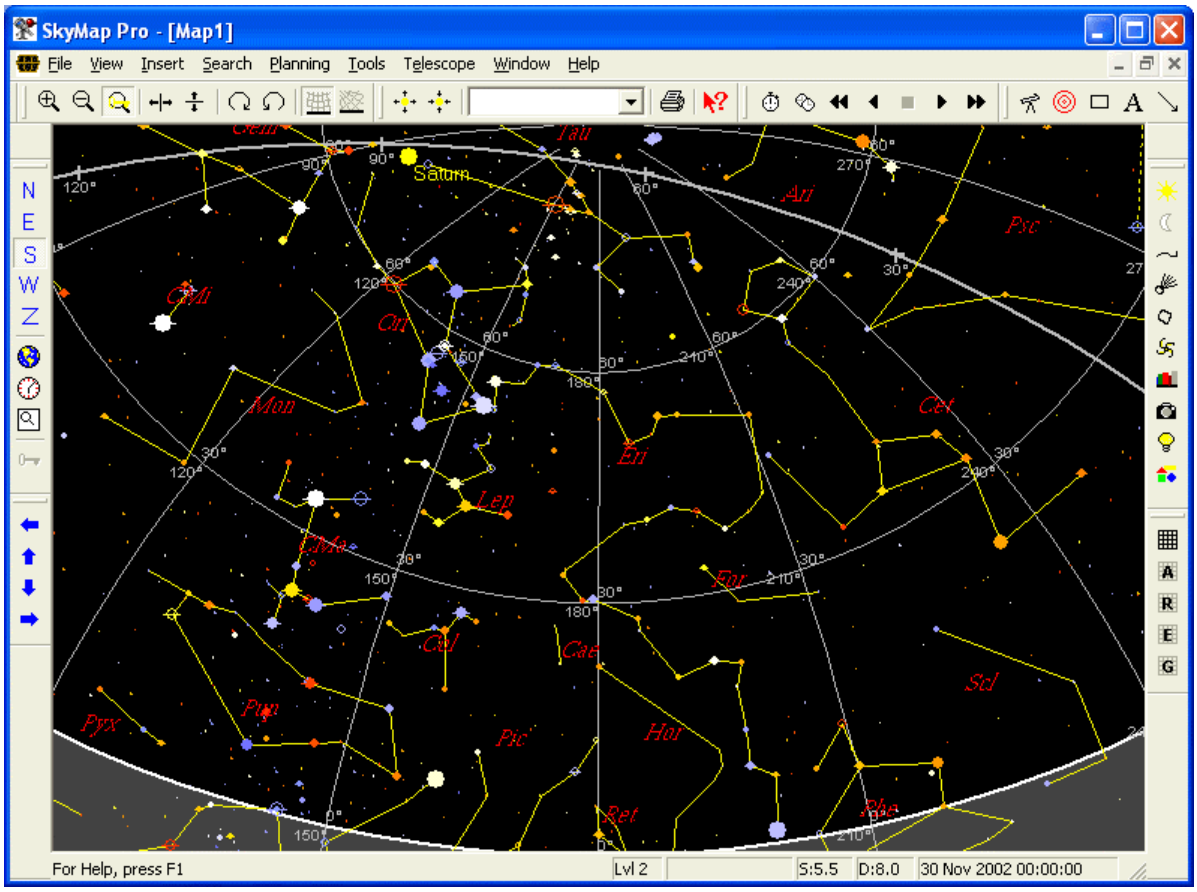
For the purposes of this tutorial, let us suppose that you live in Miami, Florida. Using the scroll bars, scroll through the list of place names to reach the country name "USA", and then scroll through the list of place names in the USA (which are arranged in order of state name) until you find "USA:FL:Miami". 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:



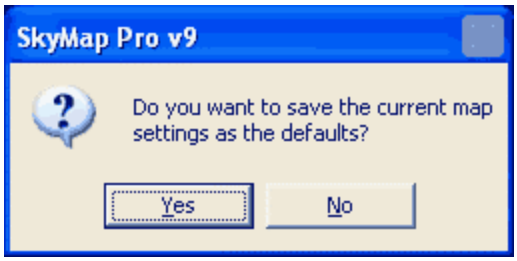
If you compare this map with the ones shown in the previous lesson, you'll see that Orion is now much higher up in the sky, and the bright star "Achernar" (which can never be seen from England) is visible just above the horizon to the right of the map centre, at about azimuth 190°.

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 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:

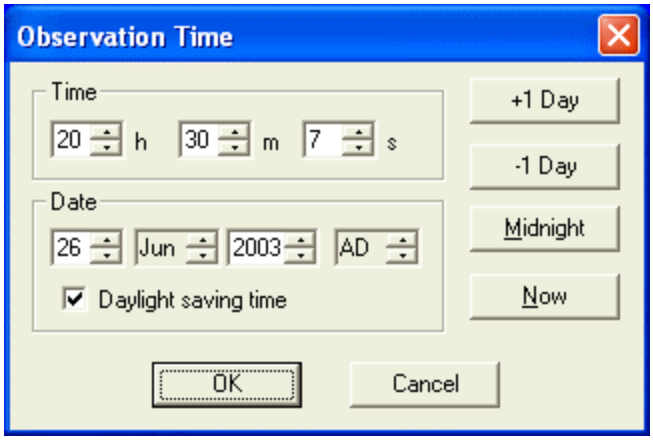


Click the **Yes** button. SkyMap will store all the current map settings as the defaults to be used whenever the program is run in the future.

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.

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.

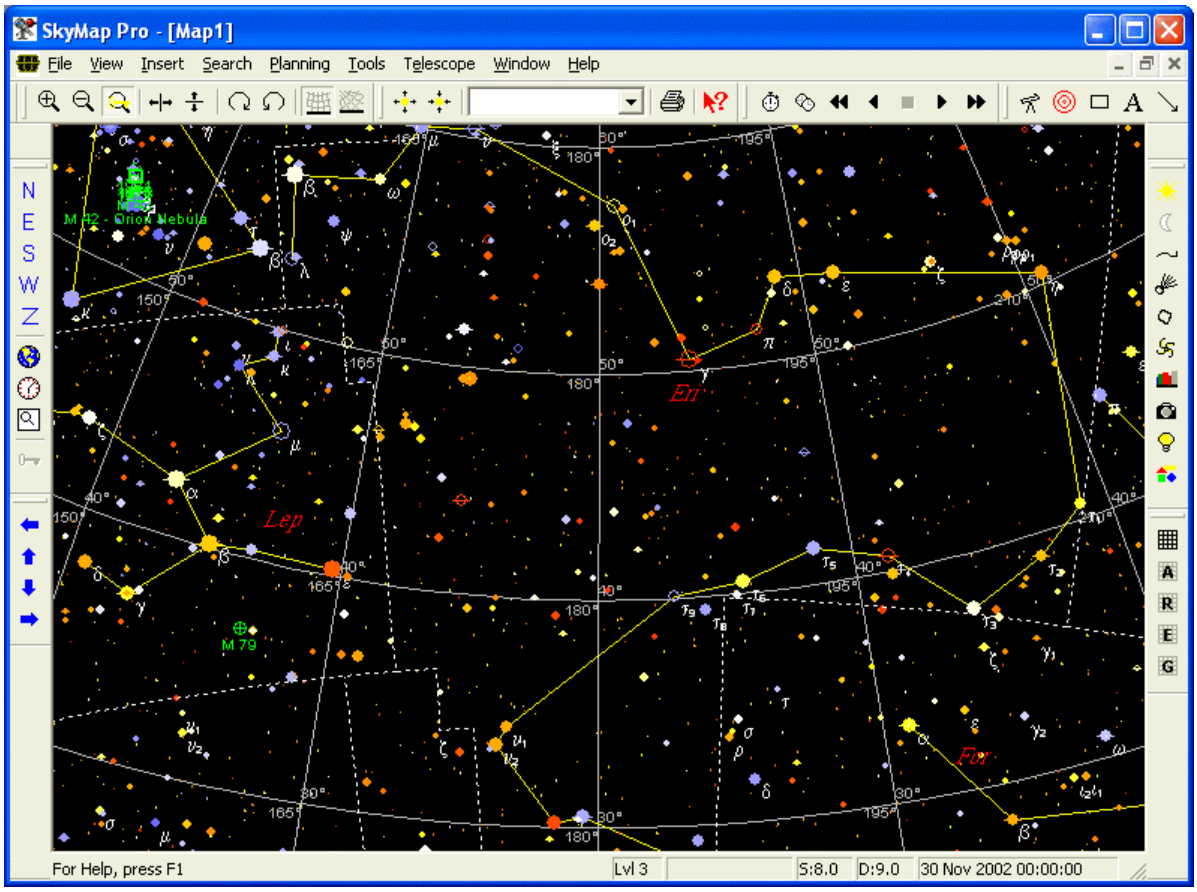
The current view level is always visible in one of the panes on the status bar at the bottom of the SkyMap window:

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.

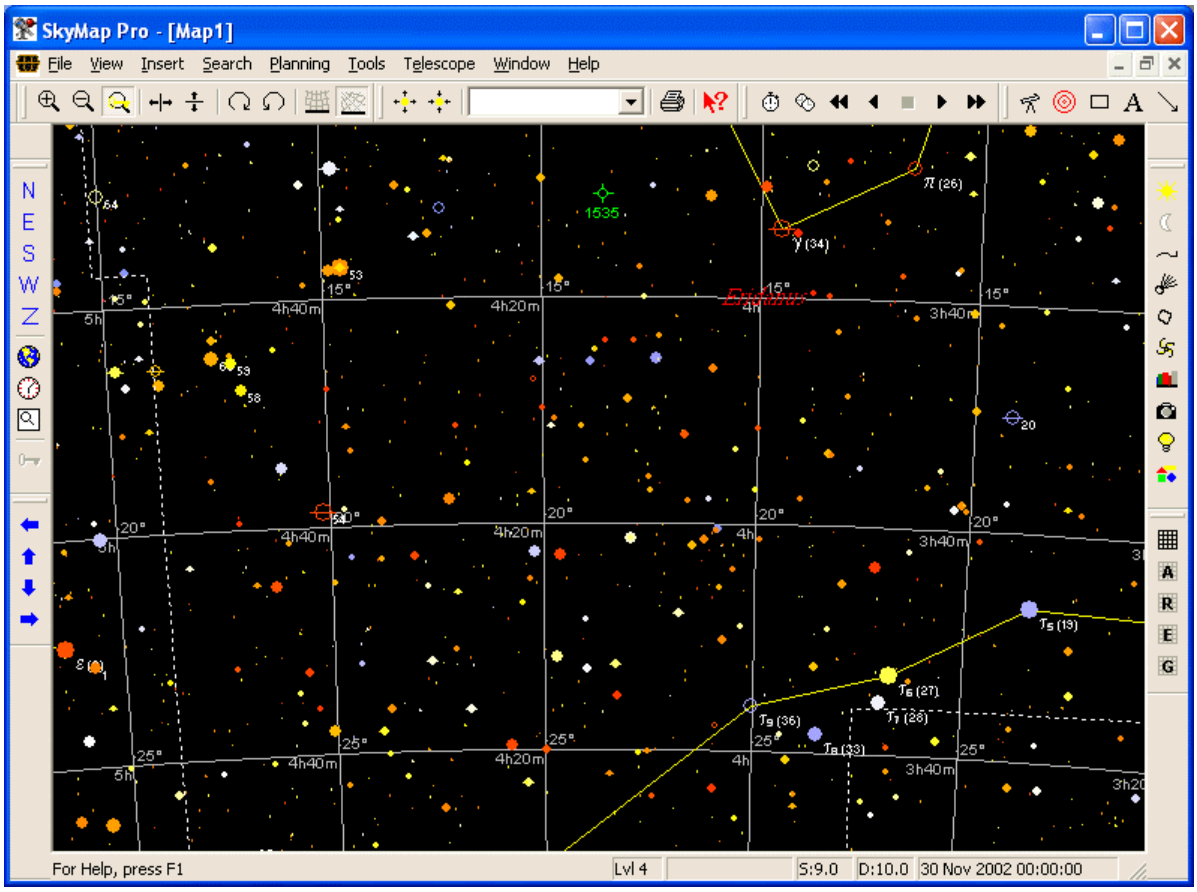
?? The bright stars on the map are now labelled with Greek letters - these are called "Bayer letters", and are the standard way of referring to the brightest stars in each constellation. Bayer letters are switched on, by default, whenever the current view level is 3 or greater.

?? 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:

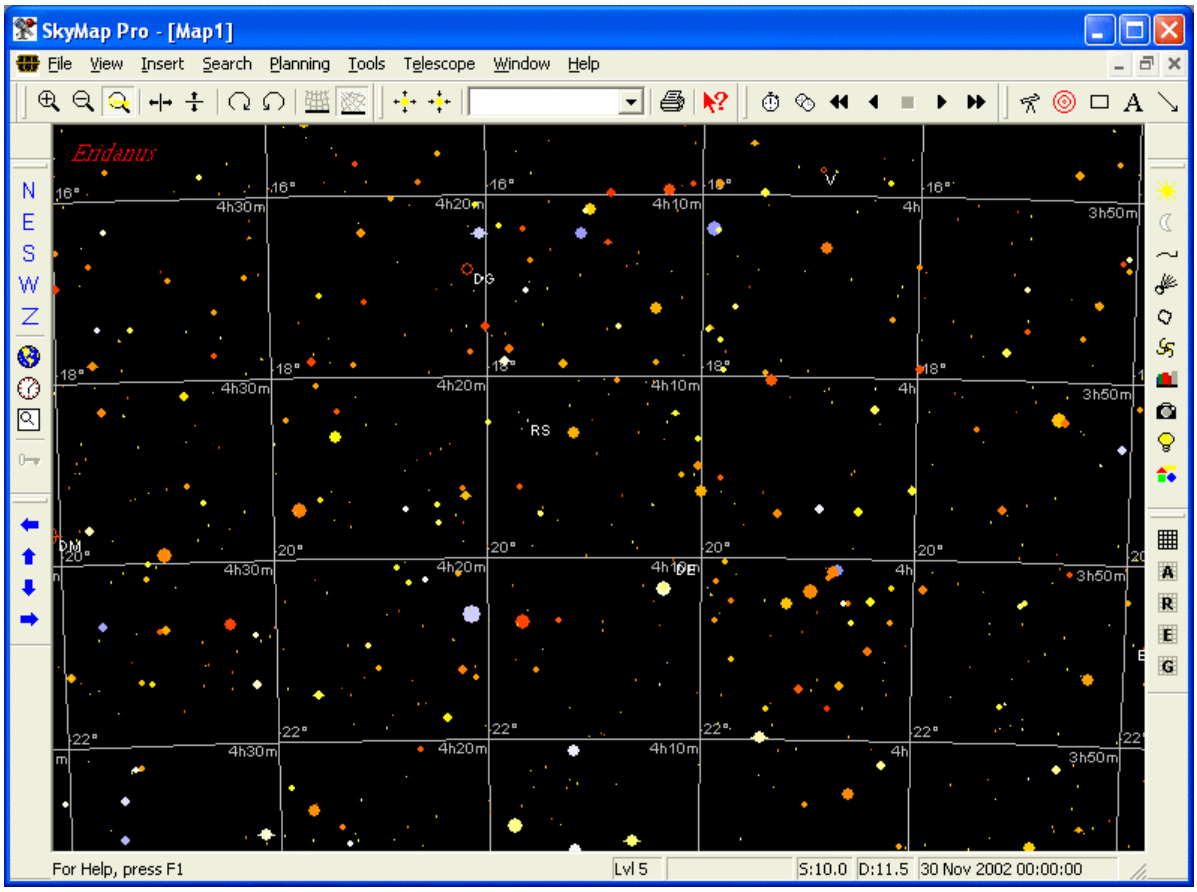
?? The status bar shows we're now at level 4, and that the map is now displaying stars as faint as magnitude 9.0.

?? 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 several fainter deep sky objects visible on the map - the ellipses (ovals) are galaxies, whilst 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).

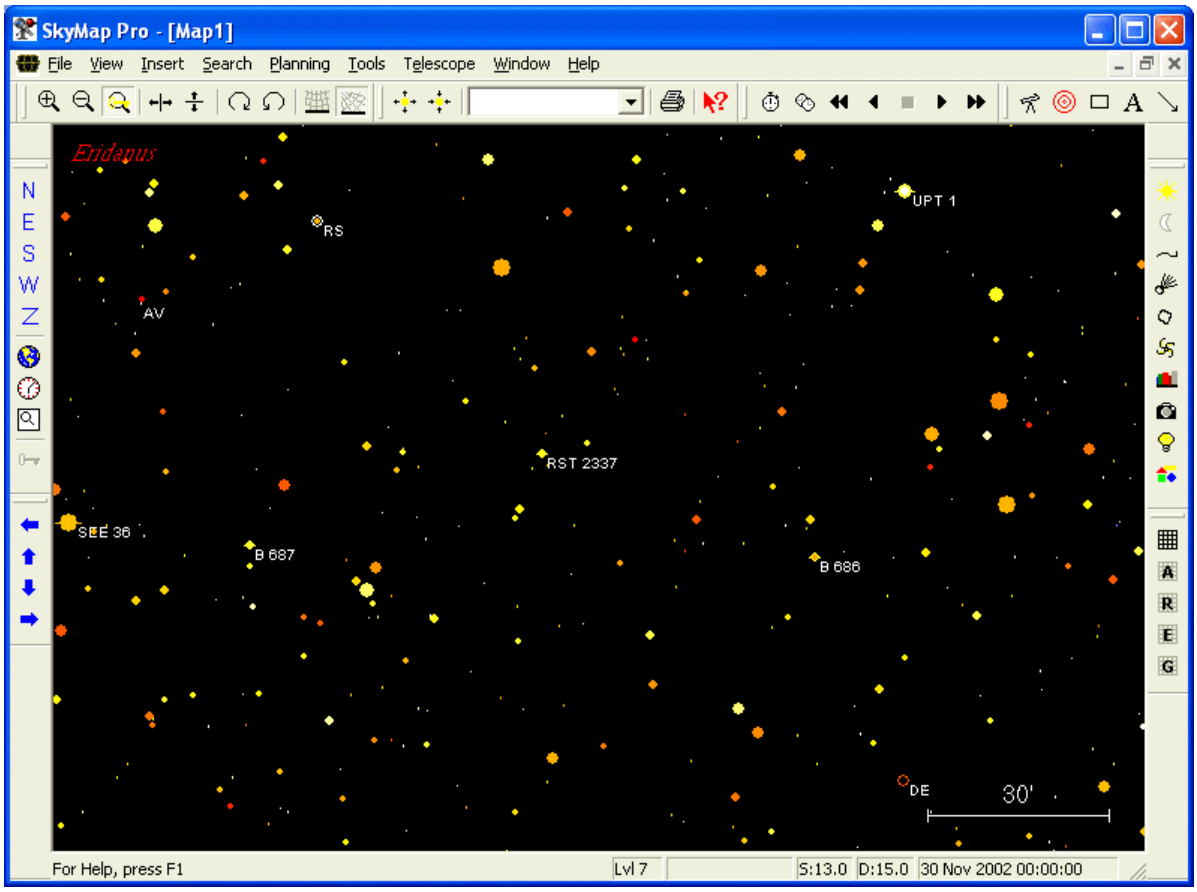
Just as before, the arrow keys can be used to move the map around the sky; the only difference now is that the arrow keys move the map along the RA/dec grid rather than the alt/az grid.

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 "RS" and “V”. These are *variable stars* - stars whose brightness varies w ith 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 v ariable 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.

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. The stars labeled “RST 2337” and “B686” are double stars; the labels are the “name list identifiers” of the stars. 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.

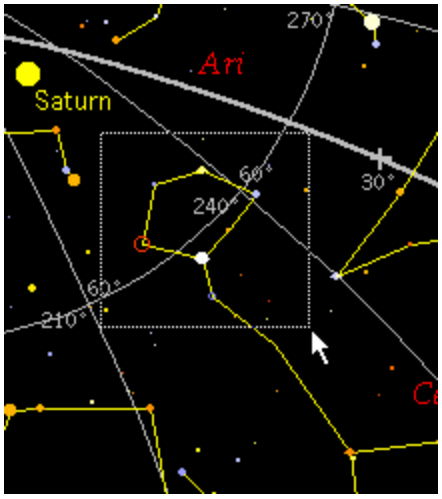
If you wish, experiment further with using the number keys to change the view level, and the arrow keys to move the map around the sky; you'll quickly discover that it's a flexible system which allows you to easily and quickly change from "wide field" views of a large area of the sky to "close up" views 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

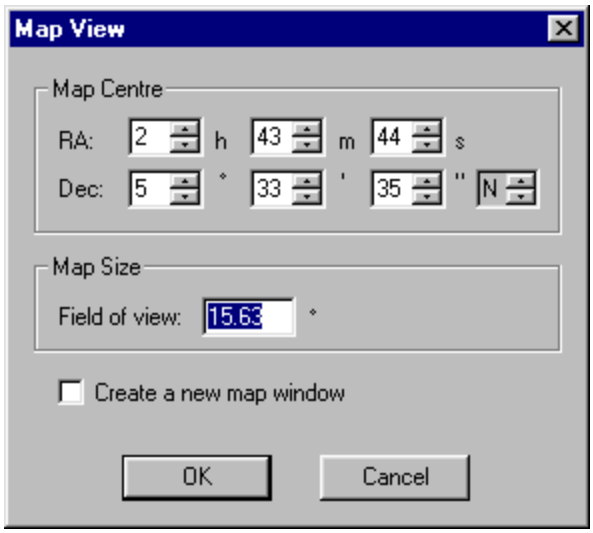
As we've seen, one method of "zooming in" on a specific area of the sky is to firstly bring that part of the sky to the centre of the window with the arrow keys, and then to use the number keys to change the view level.

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.

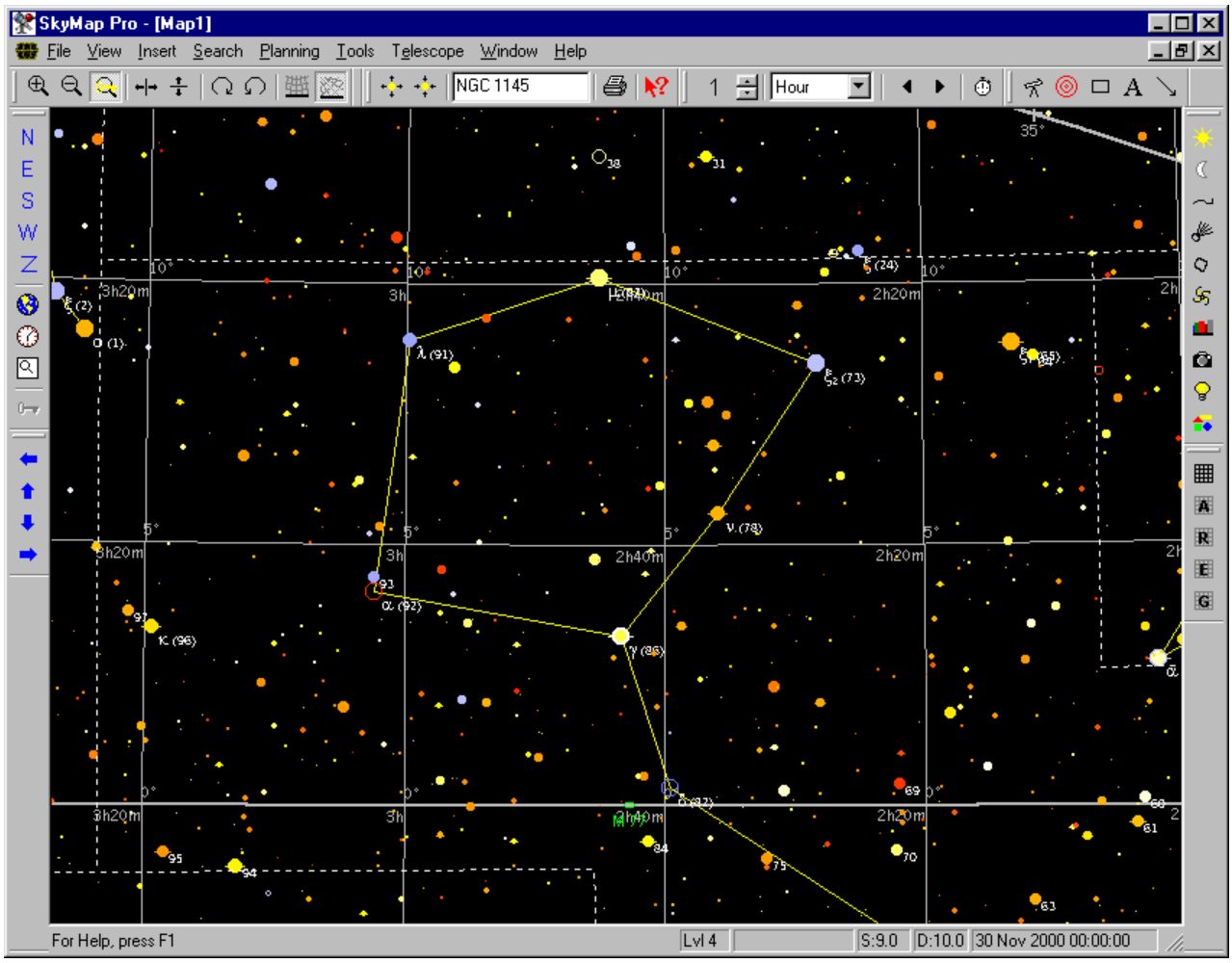
Position the mouse pointer at the top left corner of the area that you wish to zoom in on. Press and hold down the left mouse button, and then "drag" the mouse pointer to the bottom right corner of the area to be zoomed in on; as you move the mouse, a "selection rectangle" will be displayed on the screen:



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.

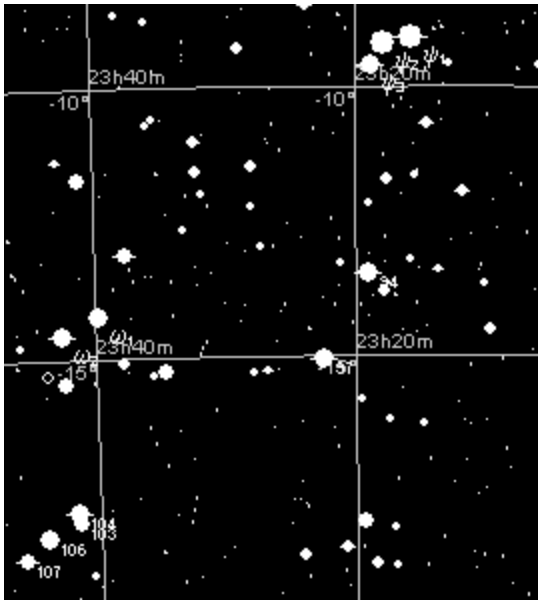
To reflect the map either horizontally or vertically, two toolbar buttons (initially located along the top of the SkyMap window) are used:

 Reflects the map horizontally.

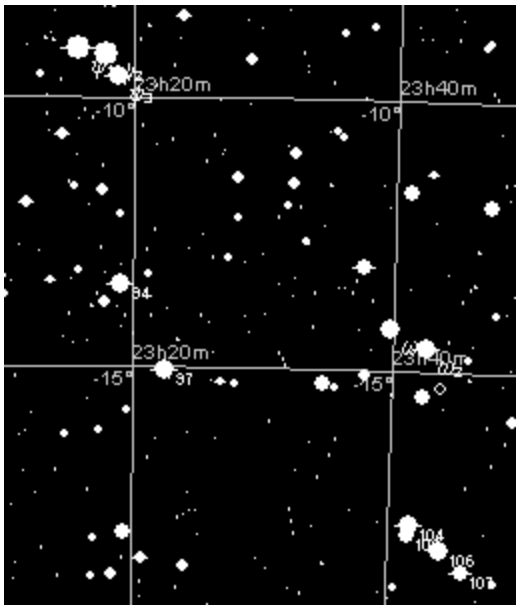
 Reflects the map vertically.

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.

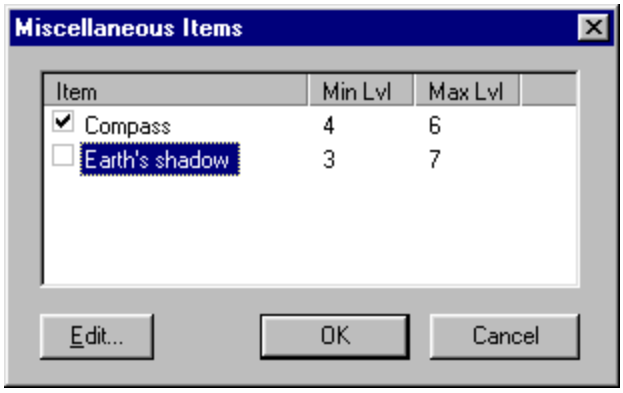
To rotate the map anti-clockwise, click the  toolbar button, or press the **Page Up** key on the keyboard.

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:

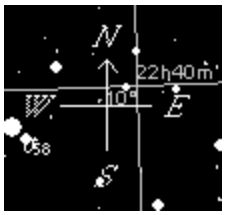


Next, click the check box to the left of the “Compass” line, and then click the **OK** button to dismiss the dialog.

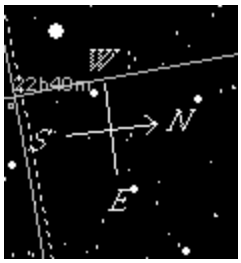
If you don't already have a map on display, zoom in to show a level 4 or 5 view of any part of the sky you wish, and then switch on the compass, as described above. The compass rose will be displayed in the upper left corner of the map window, looking something like this:

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

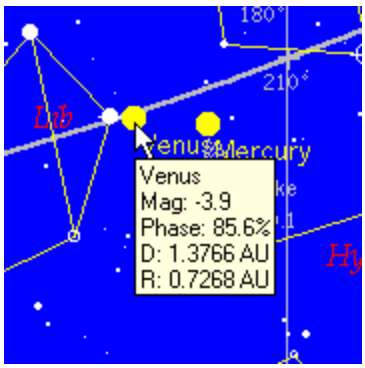
We've now seen how to display a map showing any part of the sky, in whatever level of detail we wish, for any time and date, as seen from any location on Earth. There's a lot more to SkyMap, however, than simply being able to display "dots" on the computer screen. Behind each "dot" in SkyMap's many databases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

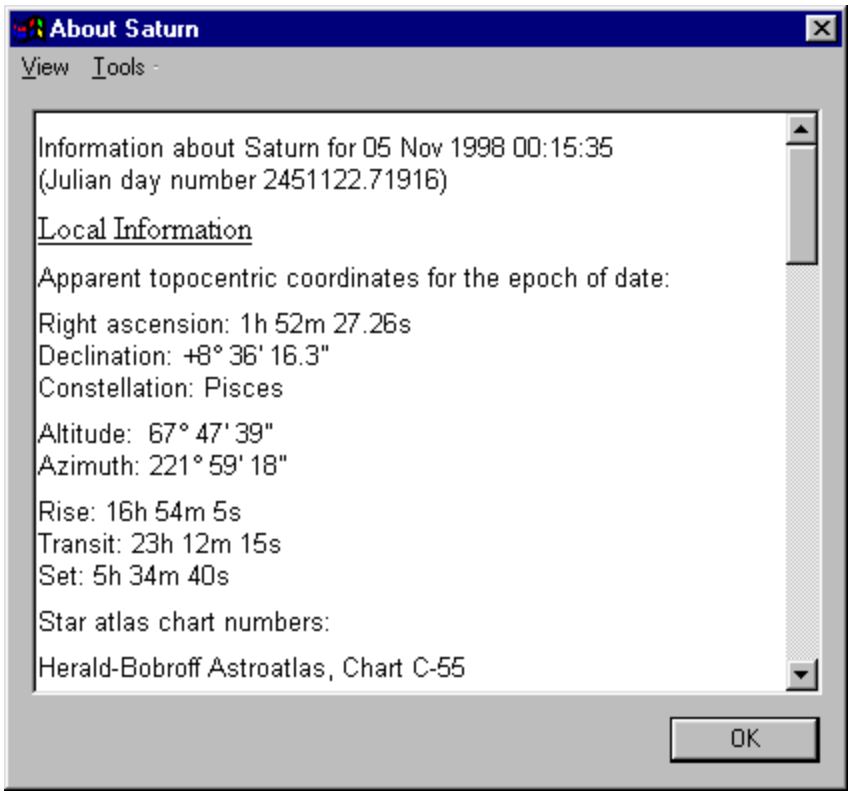
Run SkyMap, and select the standard southern horizon view, as usual. Now, using the cursor keys, scroll the map around the sky until you see a planet such as Mars, Jupiter, or Saturn. This will be shown as a large yellow dot with the planet's name immediately below, eg:

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):



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.

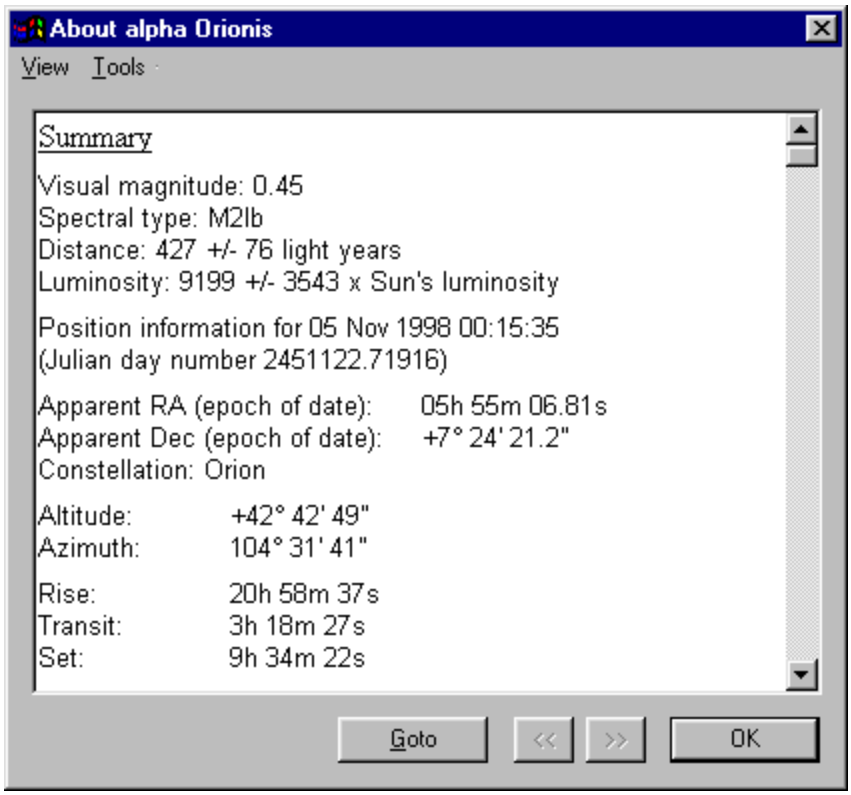
The items on the **Tools** menu provide options associated with observation logging and planning - these are described in detail in separate chapters in the manual.

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:



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.

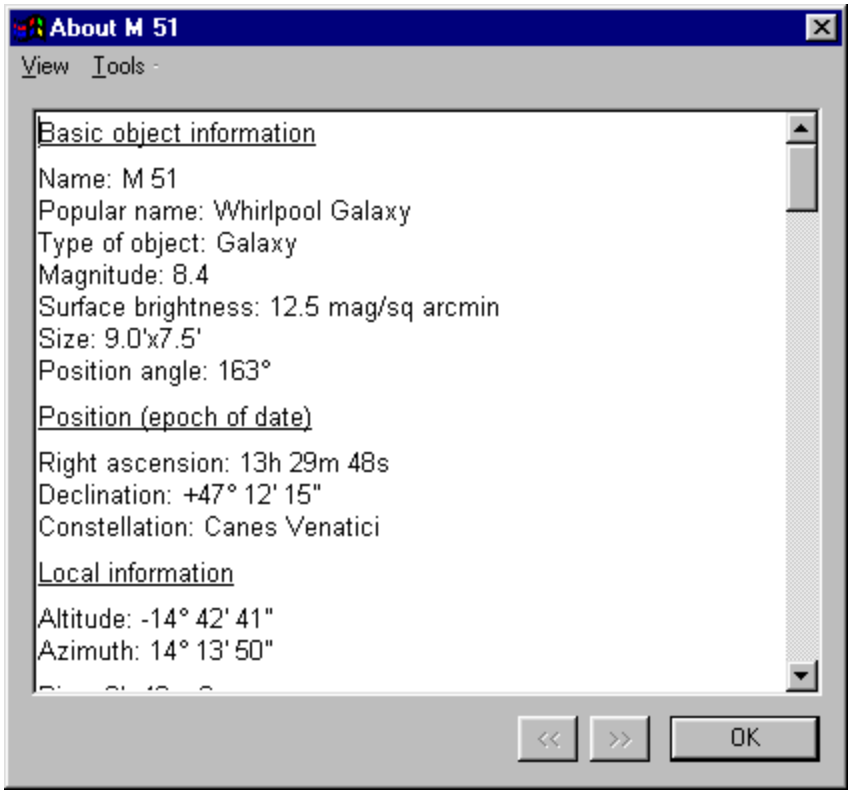
Following this "general" information, which is shown for all stars, the information dialog will then list in detail the star's "record" in each SkyMap catalog in which it appears. Some stars will only appear in one catalog, others will appear in 3 or 4 different catalogs. In general, bright stars will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

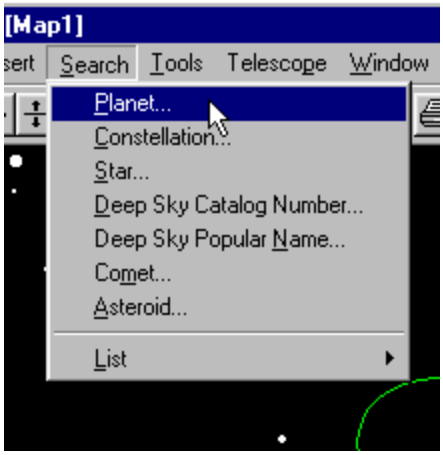
In the next lesson we'll learn how to use SkyMap's extensive search facilities to locate objects.

Tutorial Lesson 7 - Searching for objects

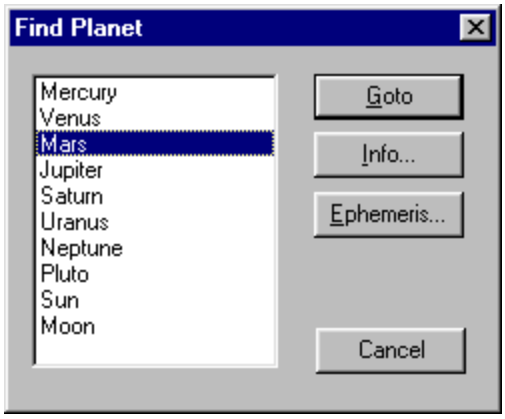
In the previous lesson we saw how to display information about any object on the map. That's a very useful capability, but SkyMap contains many *millions* of objects, and we may not always know where the object we want to know about is located in the sky. Another problem we have to contend with is the 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

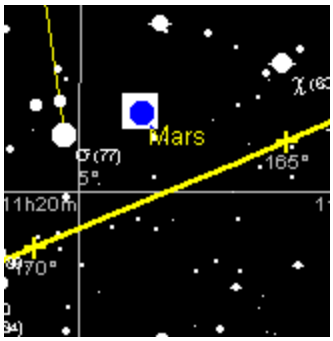
Let's search for a planet on the map. Run SkyMap, move the mouse pointer to the menu bar at the top of the SkyMap window , and select the **Search/Planet...** menu item:



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):



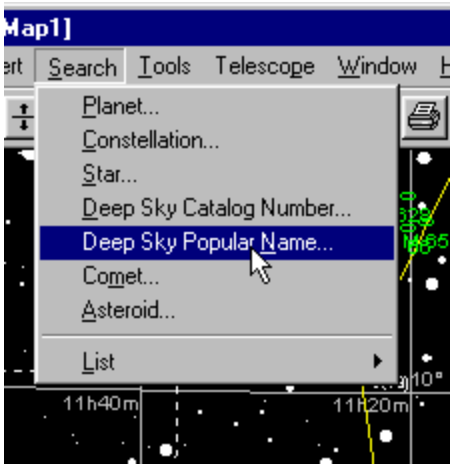
The white square is called the "search target marker", and marks on the map the location of the object which has most recently been searched for. Scroll the map around the sky, or change the view level by pressing the number keys; you'll find that the marker will remain on the map. To make it disappear, 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.

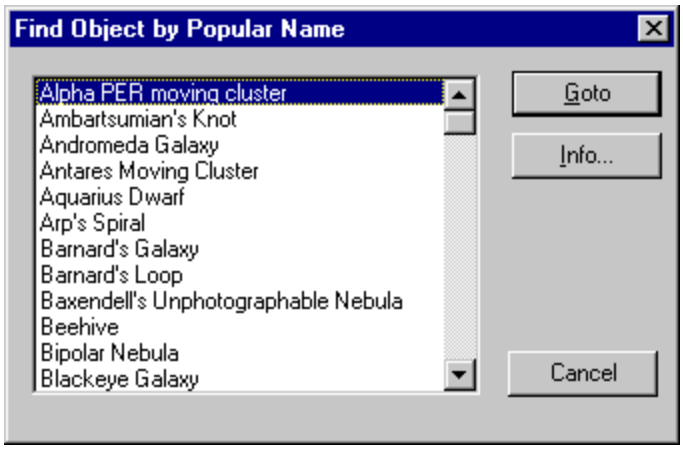
Searching for "deep sky objects" by popular name

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:



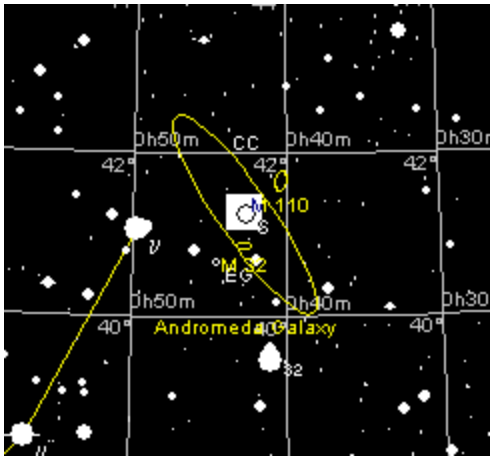
Doing this will display the "Find object by popular name" dialog box:



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.

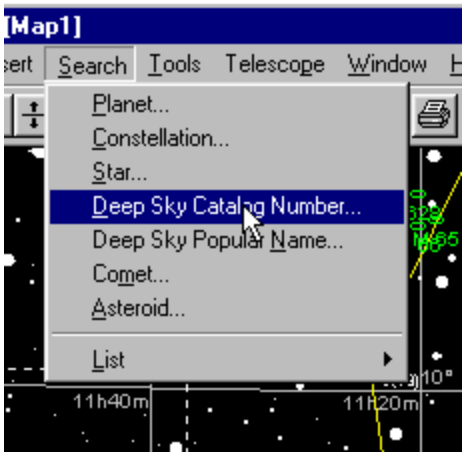
Try searching for some of the other objects in the popular name list in the same way; you'll soon find that some are shown on the map after the search operation, but others aren't. That's because the search operation always takes you to the *position* of the object being search for, but the current map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

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.

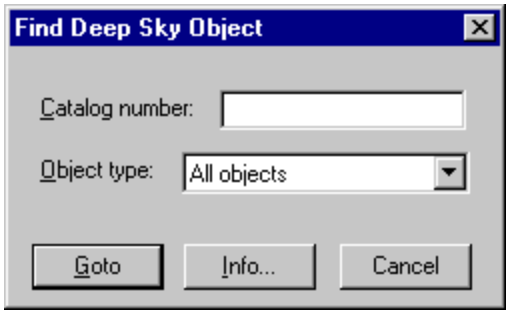
Searching for deep sky objects by catalog number

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.

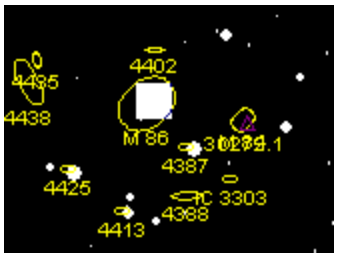
Let's look for the bright galaxy M86 which we talked about at the start of this lesson. If SkyMap isn't already running, run it, and this time press "7" to display a level 7 map of some arbitrary part of the sky. Select the **Search/Deep Sky Catalog Number...** menu item:



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.

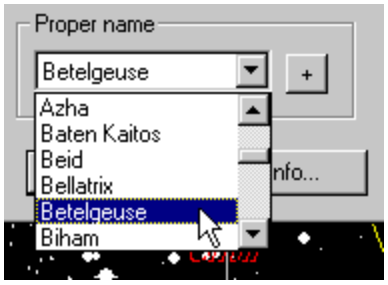
Searching for a star

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

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):



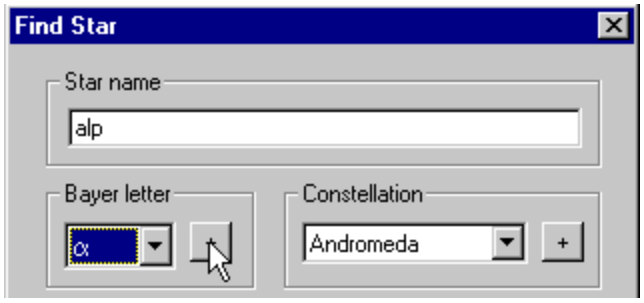
Click on the name "Betelgeuse". The list will close, with the name "Betelgeuse" shown selected. Now click the "+" to the right of the combo-box. The name "Betelgeuse" will be copied into the "Star name" field:

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.

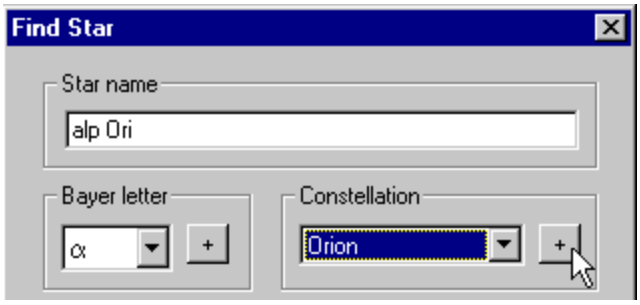
Try searching for other stars with "proper names". You can either use the "+" button alongside the list of names to copy a name to the "Star name" field, or you can directly type the name into the "Star name" field - either will work.

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):



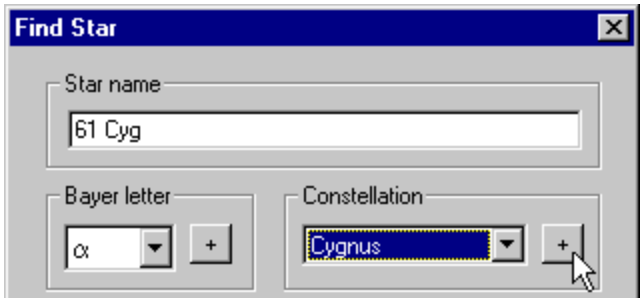
Next, go to the "Constellation" section of the dialog, select "Orion" from the list, and click the "+" button alongside the list. The letters "Ori" (the standard 3-letter abbreviation for the constellation of Orion) will be added to the text in the Star name field:



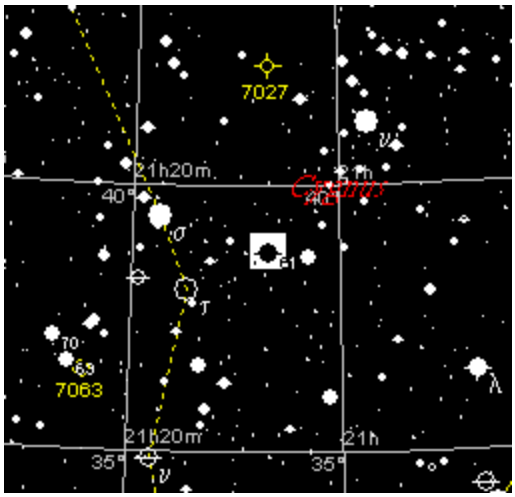
Finally, click the **Goto** button. The map (if it is not already doing so) will be redrawn, centred on Betelgeuse.

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:



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`..