MegaStar

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Chapter 1. Introduction

1.1 Installing MegaStar

To install MegaStar, follow these steps:

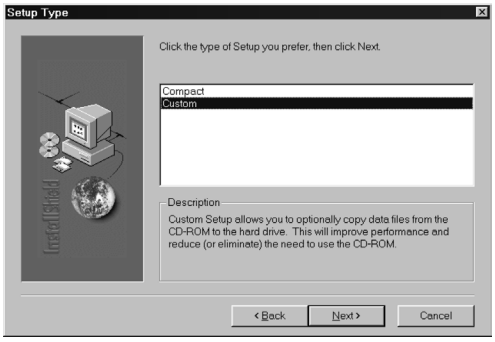
1. Insert the CD-ROM.
2. Click the Windows “Start” button and choose “Run.”
3. Type d:\setup.exe (replacing “d” with your CD-ROM drive letter) and click “OK.”

The setup program will guide you through the rest of the installation. You will be presented with a few options during this process.

The first choice to be made is the destination folder for installing MegaStar to your hard drive.

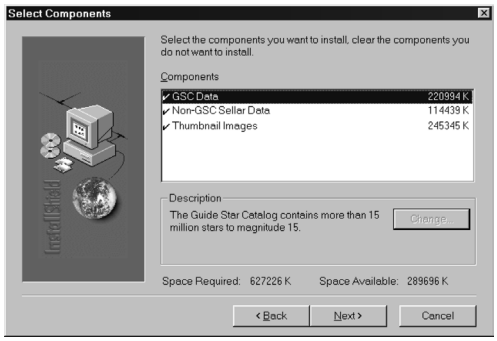
If you want to use the default location, just click “Next” at this screen. To change the destination folder, click the “Browse” button and enter the desired path.

The next screen lets you select which components you want copy to your hard drive.



The **Compact** option will copy the minimum amount of data to your hard drive (about 45 MB). You will need to insert the CD-ROM whenever you run MegaStar.

The **Custom** option lets you copy some or all of MegaStar's data to the hard drive. If you have enough free disk space, it is strongly recommended that you choose this option, and put as much of the data on the hard drive as you can. This will improve the performance of MegaStar, and reduce (or eliminate) the need to use the CD-ROM whenever you run MegaStar. The most important components are the GSC data and Non-GSC Star Data. If you choose "Custom," then clicking "Next" will present the following screen:



The components with a "checkmark" will be copied to the hard drive. To deselect a component, click directly on the checkmark to remove it. The **GSC Data** and **Non-GSC Stellar Data** are required for running MegaStar, whether they are accessed from the hard drive or the CD-ROM. By selecting both of these components, it will not be necessary to use the CD-ROM when running MegaStar (except to display thumbnail images).

The **Thumbnail Images** are optional, and are not required for the "normal" operation of MegaStar. But by putting the image data on the hard drive, they will be made available without the need for the CD-ROM. Note that these images are extracted from the RealSky. So if you already have the RealSky CD-ROMs, there is probably no need to select this component (especially if you plan to put the RealSky data on your hard drive, as described in Section 9.9 on page 88).

At the conclusion of the installation process, you will be asked if you want to put a shortcut icon on your desktop. This is usually the most convenient way to launch MegaStar, and is recommended. Whether you choose the desktop icon or not, a "MegaStar" Program Group will be created, which will contain the shortcut for launching MegaStar. This Program Group can be accessed through the "Programs" list of the Windows "Start" menu.

Note: If you choose not to copy components to your hard drive during installation, you can still copy them manually at a later time by following this procedure:

1. Insert the CD-ROM.

2. In Windows Explorer, find the folder(s) you wish to copy. The folder names are as follows:
GSC Data folder: GSCData
Non-GSC Stellar Data folder: StarData
Thumbnail Images folder: Images

3. Drag the desired folder(s) to a location on your hard drive. Probably the best choice would be to make them subdirectories of the folder to which MegaStar was installed. *Be sure to drag the folder itself, and not just the files inside the folder*.

4. With the CD-ROM still inserted, run MegaStar and go to the "File | Select Directories" menu. This will display the "Directory Paths" dialog box.

5. For each data group that you moved, enter the new hard drive path. Browse buttons are provided for convenience. Then click the OK button.

6. Megatar will now access those components from the new location that you specified.

1.1.1 Running MegaStar

To launch MegaStar, double-click on the "galaxy" shortcut icon, either from the MegaStar Program Group or the desktop icon.

1.2 Nomenclature and Conventions

This section explains some terms and conventions used throughout this User's Guide.

The term **DSO** stands for "Deep Sky Object." These are objects which are outside our solar system, such as galaxies, globular clusters, and planetary nebulae. This term does not apply to stars, double stars or variable stars, even though they are technically in the "deep sky.".

There are several terms that refer to generic Windows operations.

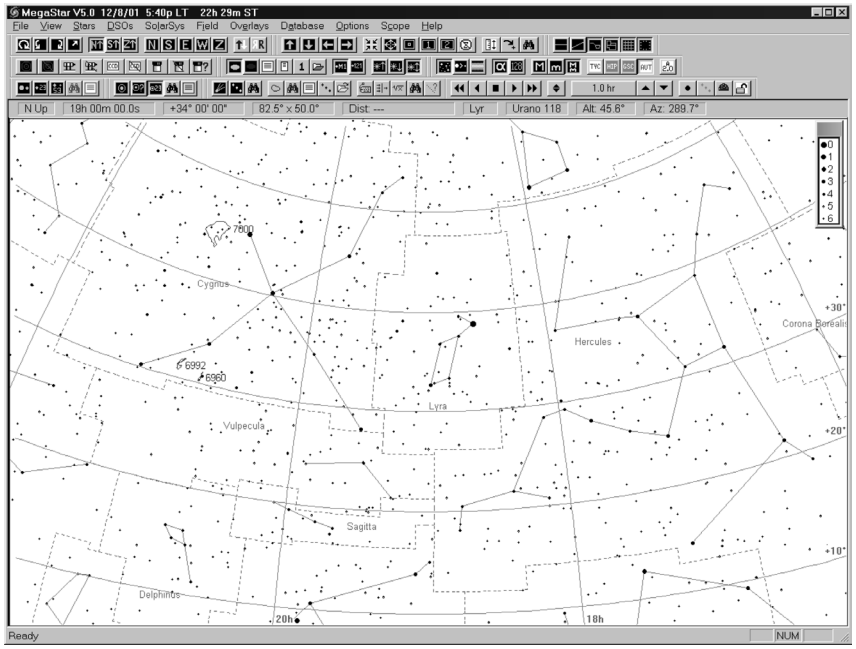
The mouse, of course, controls the cursor. To **click** on an object means to place the tip of the arrow cursor over the object, and then press and release the mouse button (usually the left button). To **double-click** means to press and release the button twice in quick succession. To **drag** an object (move it around), position the cursor and press (but don't release) the mouse button. The object will move along with the mouse pointer, until the button is released.

A **dialog box** is a "window" that appears on the screen that can provide information and/or enable you to communicate with the program. It always requests a user response, even if it is simply to press the Enter key or click the "OK" button. Dialog boxes are used for setting various parameters or issuing commands to the program.

When a dialog box contains "text input" boxes, you can double-click on the text

box to highlight the contents. When you begin typing, the old contents will disappear. When there are multiple text boxes, the “tab” key can usually be used to move from one to another. For scrollable list boxes, typing a keyboard letter will scroll the list down to the first entry starting with that letter. You can also use the PageUp, PageDown and arrow keys to scroll the list.

The Windows menu system is hierarchical, so that a menu item can invoke a submenu. When you choose “Stars” from the menu bar, a list of further menu options will appear, such as “Shrink”, “Remove”, etc. The “|” symbol is used to indicate the “path” to a particular menu option (for example, “Stars | Shrink”).



1.3 Screen Components

When you run MegaStar for the first time, the window will appear similar to the one shown above.

Starting at the top, the main components of the MegaStar window are:

Caption Bar. Displays the current local time, sidereal time, etc.

Main Menu.

Toolbars (three rows)**.** These provide an alternative to navigating menus, performing various functions directly.

Readout Bar. Displays information about the current field, such as field size, center coordinates, orientation and constellation.

Field Area. This is where the chart is displayed. A star symbol magnitude leg-

end appears at the upper right (this can be removed by pressing F2).

Status Bar (bottom of window). Displays certain system settings,such as the current state of the Num Lock, Caps Lock, and Scroll Lock keys.

1.4 Mouse Functions

The mouse performs several functions when it is within the boundary of the field area.

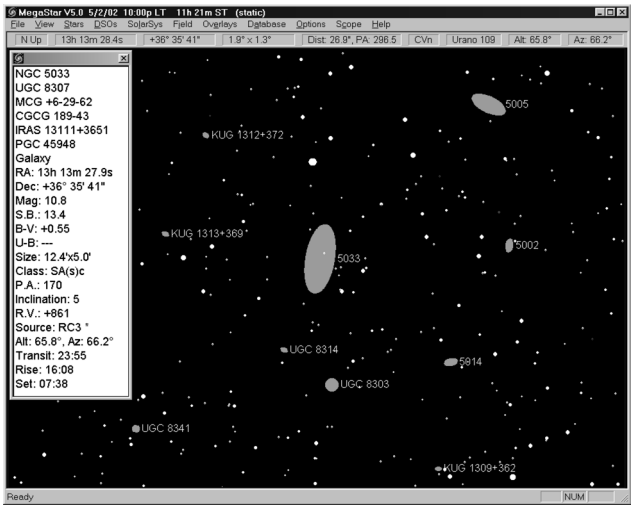
1.4.1 Left Mouse Button

Single-clicking the left mouse button will update the information in the Readout Bar, and identify an object that is clicked on.

The **coordinates** in the Readout Bar will be updated, corresponding to the cursor position.

The **distance readout** in the Readout Bar will also be updated, indicating the **angular distance** and **position angle** between the last two consecutive left button clicks. The initial value of the distance does not have to be zero when measuring distances between two objects in the field.

If the cursor is "near" the center of a star or nonstellar object when the left button is clicked, a **data box** containing descriptive data for that object will be displayed. See the illustration at right. "Near" means 12 pixels in the case of nonstellar objects, and 6 pixels in the case of stars. For very large objects, it may be difficult to locate the center, and several attempts may be necessary. To remove the data box, press the Escape key or else click the left button on a blank area of the field. For most types of data boxes, you can right-click on the box's window to display a context menu of additional options. Refer to Chapter 13. on page 115 for more information about data boxes.



The left button is also used to execute a **stretchy box zoom**. First, position the cursor approximately where you want the lower left corner of your zoom box. Press the left button and continue to hold it down. Moving the cursor up and to the right will cause the box to expand. Shrink the box by moving the cursor down or to the left.

If you press the *right* mouse button (*without releasing the left*), you will go into "drag" mode, and the entire zoom box can then be moved. Releasing the right button puts you back into "stretch" mode. You can go back and forth between stretching and dragging repeatedly.

When the left button is released, the zoom box is frozen in position and a dialog box will be displayed, prompting you to accept or cancel the zoom operation. This confirmation check can be suppressed if desired (Section 8.7 on page 78.).

Note: The center of the zoomed field will always match the center of the zoom box. However, the relative proportions of the zoom box may not match the shape of the MegaStar window, so you may not get the exact area of the field that you requested.

If you **double-click** the left mouse button within the field area, the chart will re-center at the cursor position.

1.4.2 Right Mouse Button

The right mouse button will display a context menu, which contains various commands and options. The contents of this menu can be customized by choosing "View | Configure Context Menu." You can also choose not to display a context menu at all by unchecking "View | Use Context Menu." In that case, the right mouse button will always re-center the field at the current cursor position (this is the same as the "Center Here" option in the context menu).

1.5 Toolbars

The large number of toolbars which MegaStar initially displays may be more confusing than helpful at first. And you might be very dismayed by the space that they consume (especially if you are using the minimum resolution of 800x600). But you can remove any or all of these toolbars. "View | Select Toolbars" will allow you choose which toolbars you want to display. "View | Show Toolbars" will alternately turn the toolbars on or off, without affecting which ones have been selected. Until you become familiar with the operation of MegaStar, you may want to just remove the toolbars for now.

Initially, all toolbars will be in their **docked** state (they are "attached" to the MegaStar window). Any or all of these can be **floated** (moved to any position on the screen). Refer to **Appendix C on page 129** for instructions on how to manipulate the toolbars.

MegaStar employs "tooltips" and "flyby text" to help identify toolbar functions when the cursor is placed over a button (without clicking on it). A tooltip is a small text box which is displayed near the toolbar button. Flyby text is a longer description of the function, which appears in the status bar at the bottom of the MegaStar window.

1.6 Accelerator Keys (Hot Keys)

Nearly all of MegaStar's functions can be accessed through the menu system. Most of these functions can also be executed by using accelerator keys (more commonly

known as hot keys), to provide more direct access.

Unlike most other programs, where hot keys are pre-defined, MegaStar allows you to select your own hot keys. A default configuration is initially provided, but this can be changed by clicking the “View | Set Hot Keys” menu.

For example, to create an Eyepiece View, you could choose “Field | Eyepiece View” from the menu, or else press the “E” key on the keyboard.

To view the hot key list, choose “View | Set Hot Keys.” A dialog box will be displayed which lists all of MegaStar’s functions to which a hot key can be assigned, and what the current setting is. The “Notepad” button will display this information in a Notepad window, which you can then print or save to a file.

Note that some hot keys will have a toggle action: repeating the function will produce an opposite action, or undo the previous action. For example, if typing “R” removes the stars, typing “R” again will redisplay them.

Refer to Appendix D. on page 133 for a list of the default hot key settings.

Chapter 2. Overview

This chapter is intended to give you an overview of MegaStar's capabilities, with minimal implementation details. You can find the details by turning to the section of the manual that will be shown in parentheses nearby each feature as it is discussed.

MegaStar is a powerful sky charting tool with a multitude of features. Although the program contains numerous options and commands, great effort has been made to ensure that the basic functions are as understandable and simple to use as possible. For many users, these basic functions alone will be sufficient for their needs, and it will not be necessary to explore the more "subtle" features that the program offers before getting it installed and running. This section gives a brief overview of the most commonly-used commands, plus some of the more advanced features which you may find useful.

Typical uses of MegaStar include the following:

- Planning observing runs. In this case, the program is run at work or at home on a desktop PC to create printed charts and data tables for use at the telescope. Many visual observers particularly like this feature because they save valuable time out under the stars for actual observing plus they can remain fully dark adapted, something that is difficult to do with a computer display.
- During observing runs. In the field MegaStar generally runs on a laptop PC. Here the maps and datatables are always available for display and you get the added features of telescope interfaces provided your scope has digital setting circles, and uses one of the more common interfaces.
- As a research tool. The possibilities here are almost limitless but two immediately come to mind: First, you may load images from the Digital Sky Survey via the internet from Real Sky and overlay map outlines from your own database to verify positions, sizes, etc. Second, CCD photometerists routinely use MegaStar at the telescope and the included Guide Star Catalog files in conjunction with *Astronomical Image Processing for Windows* (AIP4WIN) to acquire and reduce data.
- To explore the sky and learn "what's out there" from the comfort of your arm chair. Many people use *Uranometria 2000.0* as their "big picture" and jumping off point and then turn to MegaStar to zoom in on interesting objects at incredible magnifications.

To begin our overview of MegaStar we will explore the features that are common to all of its uses. Then we'll look at some things which are particularly useful for planning observing sessions both while at home and later at the telescope.

2.1 Executing Commands

MegaStar provides unprecedented flexibility in its user interface. Most Windows programs provide alternate ways of executing commands: menus, hot keys, toolbars, and context menus. MegaStar does this also, but takes that flexibility a step further by enabling you to do a significant amount of customizing that will give you a highly personalized interface, one that will reflect how you work and think and therefore will be easy to use. All of the interface customization tools can be found in the "View" menu (Chapter 4).

2.1.1 Menus

The most obvious way to get the program to do something is to use the menu system. If you have the Status Bar displayed in the MegaStar window, it will contain a brief description of the menu item that is currently highlighted. A menu item becomes highlighted when the mouse cursor passes over it. (Note: the description may not be immediately visible with a slow computer or one that has several programs running, so you may have to hold the cursor over it for several seconds.)

With the exception of the Solar System animation controls (Section 7.7 on page 67) every MegaStar command and option can be accessed through the menus and their corresponding dialog boxes.

2.1.2 Hot Keys

Most programs provide "hot keys" to execute selected commands. Often these involve the use of awkward control-alt key combinations, and you're restricted to using whatever the programmer has chosen. **But with MegaStar, you can choose your own hot key assignments** (Section 4.8 on page 35). Frequently-used commands can be assigned convenient keys, such the Space Bar or Enter key—which allows you to avoid the use of awkward and often hard to remember key combinations. You may also find it even easier to remember the hot key settings when you have chosen them yourself. Of course, you can always simply use the initial default settings which MegaStar provides.

Hot key assignments can be added, deleted or modified as your needs change.

In addition, you can set up multiple hot key configurations, and load them as needed. We even provide configuraions which will emulate some other charting programs, in case you are accustomed to using the hot keys of another program.

2.1.3 Toolbars

Another way to get direct access to commands is through the use of toolbars. A Toolbar is a collection of buttons which you can click on to execute functions. MegaStar provides several different toolbars composed of a related group of commands. You can select which (if any) toolbars you want to display (Section 4.3 on page 33).

2.1.4 Context Menu

A context menu is a popup menu that appears when you click the right mouse button (Section 4.6 on page 34). Context menus often contain functions which are also avail-

able in the program's main menu (such as Locate Object, Zoom In, etc.), but with more convenient access.

MegaStar extends this convenience even further by allowing you to select the contents of the context menu. You can even specify the order of the commands, putting the ones that you use most often at the top of the list (Section 4.7 on page 34).

Multiple context configurations can be defined, and activated when needed.

2.1.5 Command Window

Yet another way to execute commands is the Command Window (Section 4.4 on page 33). Once again, MegaStar provides great flexibility in the use of this option. You can choose which functions you want the Command Window to contain. By selecting only those commands which you use most frequently, you can minimize the amount of screen space that the window consumes.

2.2 Setting the Field Size, Location and Orientation

The most basic function of a sky charting program is to select a field to display. Along with this are the abilities to move around the sky and change the orientation. In MegaStar, these functions are located in the "Field" menu (Chapter 8).

You can enter specific coordinates of the field center using **Set Center Coordinates** (Section 8.2 on page 76).

The **Pan** commands (**Up**, **Down**, **Left**, **Right**) allow you to move around the sky. These commands will usually be performed using the arrow keys on the keyboard, rather than clicking the menus (Section 8.11 on page 79). The distance that the field moves in response to these commands can be specified using **Set Pan Overlap** (Section 8.12 on page 80).

The size of the field (to the nearest arc-second) can be specified using **Set Field Size** (Section 8.4 on page 78).

To quickly decrease or increase the field size, zoom and mooz commands are provided ("mooz" is the opposite of zoom). There are two methods of zooming. **Auto Zoom** (Section 8.7 on page 78) will decrease the field size by a specified factor (reducing it 50%, for example). This factor can be specified using **Zoom/Preset Options** (Section 8.7 on page 78). The other method of zooming is to use the mouse to draw a box on the field, which represents the new field size (Section 1.4 on page 5). When you read that section, note the use of both mouse buttons for manipulating the zoom box. The **Undo Last Zoom** command can be used to restore the original field after zooming with the zoom box method (Section 8.9 on page 79).

Regardless of how the field size was modified, you can use **Go To Previous Field Size** to return to the previously selected field size (Section 8.5 on page 78).

Two different field sizes can be selected for use with the **Go To Preset Field Size** commands (Section 8.6 on page 78). These provide a convenient way of quickly changing the field size to one of the predefined values.

If you want to see a wide view of the sky in a particular direction, use the **Face**

North/South/East/West and **Look Up** commands (Section 8.10 on page 79). These commands will automatically switch to a wide field view having a zenith-up orientation, which shows the sky as it appears when standing on the ground looking in the specified direction.

There are a number of orientation options which can be manually selected using the **Orientation** dialog box (Section 8.3 on page 77). The field can be inverted, mirror-imaged or rotated to any desired angle. The **Rotation Tool** provides a convenient way to rotate the field using the mouse.

2.3 Selecting Which Objects to Display

Another basic capability is choosing which objects you want to display. This involves selecting various catalog options and filter parameters. These are divided into three main categories of objects: stars, deep sky objects (DSOs) and solar system objects. These functions are included under their corresponding menu groups in MegaStar's main menu.

2.3.1 Stars

To choose which star catalog you want to activate, use **Select Catalog** (Section 5.1 on page 39). The options are: Guide Star Catalog (GSC), Tycho, Hipparcos and U.S. Naval Observatory A2.0. Note that because of distribution limitations the United States Naval Observatory's A2.0 database is not included on the MegaStar CD-ROM. For information on obtaining this data, please visit their web page at www.nofs.navy.mil/projects/pmm/catalogs.html.

Each of these catalogs can be manually selected as the current stellar database. However, most users will use "Auto Select." In this mode, MegaStar will automatically switch between the GSC and Tycho/Hipparcos data, based on the current field size. For large fields, the smaller Tycho/Hipparcos catalogs are more appropriate to use. For small fields, the larger GSC can be used without overcrowding the field with stars. The star density is an even bigger consideration with the large A2.0 database, which should only be used with relatively small fields. The field size at which the GSC or A2.0 catalog becomes automatically activated can be specified.

If you have access to the USNO A2.0 data, note the "A2.0 Options" button in the Select Catalog dialog box. This dialog box provides important options for the display of A2.0 data.

2.3.2 Filtering Stellar Data

Use **Stars | Mag Filter** to set magnitude limits for the display of stars (Section 5.4 on page 41). Both a bright and faint limit can be specified. If you choose to use these magnitude filters, note that they will be static settings that will be applied at all field sizes. Normally, you will probably prefer to use "Auto" mode which will automatically choose an appropriate faint limit based on the current field size. Smaller fields can obviously handle a larger number of stars without becoming overcrowded.

The GSC can also be filtered based on an entry's classification: star, nonstar, blend and artifact (Section 5.8 on page 42). To distinguish those GSC objects which

have a nonstar classification, you can choose to plot them in a specified color.

2.3.3 Variable Stars

There are two variable star catalogs included with MegaStar: *General Catalog of Variable Stars* (GCVS) and *New Catalog of Suspected Variable Stars* (NSV). Use the **Stars | Variables** menu to activate either or both of these (Section 5.10 on page 43).

2.3.4 Filtering Variable Stars

The Variable Star Options dialog box (Section 5.10 on page 43) provides options for selecting bright and faint magnitude limits. If you choose to use these magnitude filters, they will be static settings that will be used at all field sizes. Normally, you will probably prefer to use "Auto" mode. In this mode, MegaStar automatically chooses an appropriate faint limit based on the current field size.

2.3.5 Double Stars

MegaStar includes the *Washington Catalog of Double Stars* (WDS). Use the **Stars | Double Stars** menu to activate this catalog (Section 5.12 on page 45).

2.3.6 Filtering Double Stars

The Double Star Options dialog box (Section 6.1 on page 49) provides options for selecting bright and faint magnitude limits for double stars. If you choose to use these magnitude filters, they will be static settings that will be used at all field sizes. Normally, you will probably prefer to use "Auto" mode. In this mode, MegaStar will automatically choose an appropriate faint limit based on the current field size.

You can also filter the display of double stars based on the separation of the components. Enter the minimum and maximum separations of the double stars you want to display.

2.3.7 Deep Sky Objects

Use **DSOs | Database Options** to select the desired DSO databases (Section 6.1 on page 49). MegaStar supplies two databases: Primary and *Mitchell Anonymous Catalog* (MAC). The Primary is an integrated database of objects which has been compiled from numerous sources. The MAC is a database of over 117,000 faint galaxies compiled by Larry Mitchell. Note that the MAC data will not be initially activated when you first install MegaStar. If you wish to display this data, you must manually activate it from the Database Options dialog box.

In addition to the Primary and MAC, there is a third DSO database which can be used: the Auxiliary DSO data. This database, which is initially empty, provides a means for users to add their own data to MegaStar. Refer to Section 6.9.3 on page 59.

2.3.8 What Makes MegaStar's Data Different?

Some charting programs simply dump a lot of "raw" DSO catalogs into their database. Unfortunately, nearly every astronomical catalog contains errors, and for some the error rate is quite high. It can be very frustrating to waste valuable observing time searching for an object which "isn't there" because a catalog contained incorrect

coordinates. Therefore, we have put a great deal of effort into producing an improved database. Many hundreds of hours have been devoted to searching for (and correcting) catalog errors. The majority of the DSOs in MegaStar's database have been compared against RealSky images. When an error in an object's position or orientation was found, it was corrected.

We certainly don't claim that our data is perfect, but we are confident that it is vastly superior to the original catalogs from which our database was compiled.

2.3.9 Filtering Deep Sky Objects

There are several ways in which the display of DSOs can be filtered.

You can limit the display to only selected types of objects (Section 6.2 on page 53). For example, if you want to display only planetary nebulae, you can select only that type.

You can set a magnitude limit for DSOs (Section 6.3 on page 54).

The display can be limited to selected catalog designations (Section 6.4 on page 54). For example, you can choose to display only those objects which appear in the Hickson or Arp galaxy catalogs.

As with stars, large fields can become overwhelmed with DSOs unless some filtering is employed. As the field size becomes larger, the number of DSOs that are displayed must be reduced to prevent overcrowding. The options described above are not adequate for designing an automated method of filtering DSOs based on the field size. Magnitude filtering comes the closest, but is still not acceptable. Therefore, the objects that are displayed for a given field size have been hand-selected. For example, at the largest field sizes, the display will be limited to primarily Messier objects and a few prominent large nebulae. As the field size decreases, more and more objects are displayed, based upon various criteria for determining the "importance" of a given object. But you may not always agree with our selections. Therefore, we have provided the capability of changing those selections. For example, if you feel that NGC 1300 should be given a higher priority for being displayed in larger fields, you can do so. Section 6.1 on page 49 describes how objects are filtered based on the field size, and how you can change the object selections.

Another DSO filter option uses the concept of object "groups." MegaStar supplies three predefined groups: Herschel 400, Herschel 400 II and Herschel 2500. These are object lists for observing programs sponsored by the Astronomical League. By selecting one of these groups, the display will be limited to only those objects in that list. You can also create up to three of your own object groups, called User Group 1, 2 and 3. Refer to Section 6.1.3 on page 53.

The final filter option is the Observing List, which is a list of objects that you have compiled (Section 2.8 on page 18). You can create as many of these lists as you want, and select the one to be currently active.

2.3.10 Solar System Objects

Use **SolarSys | Select/Compute Objects** to choose which solar system bodies you want to display (Section 7.2 on page 63). These include the sun, moon, planets, com-

ets and asteroids. Unlike stars and DSOs, solar system object positions are not static, and must be computed for a particular date and time.

MegaStar provides three different methods for plotting solar system objects: single points (Section 7.2.1 on page 63), tracks (Section 7.2.2 on page 64) and animation (Section 7.7 on page 67). The first two methods are "static" displays, showing the positions of objects for specified dates and times. "Animation" mode lets you view the apparent motion of these bodies in the sky.

Regardless of which plotting mode is used, a reference date and time must be selected. For the single point mode, use the **Set Date/Time** function. This function can be accessed from two different places in MegaStar: a menu item under the Options main menu (Section 11.8 on page 102), or a button in the Select/Compute Solar System Objects dialog box (Section 7.2 on page 63). Animation mode uses this same date and time reference, using the single point positions as the starting point of an animation sequence.

For tracks, multiple object positions will be plotted simultaneously on the field for a specified starting time and constant time interval. A separate date and time reference is used, which is completely independent of the single point plots. A new date/time selection dialog box will be displayed each time you create a new track.

2.3.11 Filtering Solar System Objects

Filter options are available for comets and asteroids (Section 7.5 on page 66). You can select a magnitude limit, and choose whether to suppress the display of objects having an unknown magnitude.

For comets, you can select which ones to activate for display (Section 7.9 on page 69).

For asteroids, you can set filters based on codes provided by Lowell Observatory in their asteroid element database. Or you can create filtered asteroid element files based on selected orbital element parameters (Section 7.17 on page 72).

2.4 Locating Objects

To locate most objects, the **Database | Locate Object** command is used (Section 10.1 on page 93). Simply type the name of the object you want to locate, and the field will center on that object. There are some exceptions, however. The following types of objects have their own separate locate function:

- Double Stars. Use **Stars | Locate Double** (Section 5.14 on page 47).
- Comets. Use **SolarSys | List/Locate Comets** (Section 7.9 on page 69).
- Asteroids. Use **SolarSys | List/Locate Asteroids** or **SolarSys | Locate Asteroid By Name** (Section 7.15 on page 71).
- Planet Tracks. Use **SolarSys | Locate Solar System Object** (Section 7.3 on page 65).
- Comet and Asteroid Tracks. Use **SolarSys | Track Options/Locate Track** (Section 7.4 on page 65).

2.5 Viewing Images

The purpose of sky charting software is to show you what is in the sky, and where. Displaying an image is usually much preferable to merely plotting symbols to represent the stars and DSOs.

2.5.1 Thumbnail Images

MegaStar provides small "thumbnail" images for about 78,000 objects (Section 9.12 on page 90). Instead of displaying these images in a separate disconnected window, as some programs do, MegaStar displays the images in the background of the field itself. This is much more useful, especially if the image contains stars that are bright enough to use as guide stars for locating a faint object.

You can determine whether a thumbnail image is available for a particular object by looking at the context menu which is displayed when you right-click on the object's data box (Section 13.8 on page 121). If "Thumbnail Image" appears in the menu, then an image of that object can be displayed.

There is also an "Auto" mode that can be activated (Section 9.12 on page 90). In this mode, an image (if available) will be displayed automatically whenever you locate an object.

2.5.2 RealSky

If you have the RealSky or Digitized Sky Survey CD-ROMs, then you can display those images in the background of the MegaStar field (Section 9.9 on page 88).

If you frequently move around the sky to widely separated locations, the need to swap CD-ROMs can become annoying. This can be avoided by putting the RealSky data onto your hard drive (Section 9.9 on page 88). To do this, you will need about 11 GB of free disk space and the LoadRS utility program which is included with MegaStar.

2.5.3 DSS FITS images

MegaStar can also display Digitized Sky Survey FITS images, which can be downloaded from http://archive.stsci.edu/cgi-bin/dss_form (Section 9.11 on page 90).

2.6 Basic Overlays

There are five basic overlays which can be displayed in MegaStar:

- Grid/Coordinates (Section 9.5 on page 87)
- Horizon Line (Section 9.7 on page 88)
- Ecliptic Line (Section 9.8 on page 88)
- Constellation Figures (Section 9.6 on page 88)
- Constellation Boundaries (Section 9.6 on page 88)

There are also field-of-view overlays for eyepieces, finder scopes and CCD frames. These are discussed in Section 9.

2.7 Customization Options

MegaStar offers a multitude of options for customizing the charts and other program components, in addition to those already discussed.

2.7.1 Colors

Most of the colors used in MegaStar can be modified by selecting the **Options | Fonts** (Section 11.1 on page 99) and **Options | Symbols & Lines** (Section 11.2 on page 100) dialog boxes. Take a moment to explore the entire list of selectable objects in the "Symbols & Lines" dialog box, which is quite extensive.

2.7.2 Fonts

With the exception of certain standard Windows components, such as the Caption Bar, Status Bar and dialog boxes, nearly every item of text displayed in MegaStar has a selectable font (Section 11.1 on page 99).

The most useful font selection is probably the object labels. MegaStar provides additional flexibility by making the settings independent for various categories of objects (DSOs, variable stars, double stars, etc.).

Note also some of the more subtle options available, such as the ability to change the fonts of the Data Boxes, Readout Bar and Command Window.

2.7.3 Symbols

MegaStar gives you great flexibility in the selection of symbols (Section 11.2 on page 100). For nearly every type of object that MegaStar displays, you have some control over the symbol that is used.

In addition to the shape and style, note the ability to select a minimum size for the symbol that is used to represent an object. In the case of DSOs, an object will be scaled to its true angular size whenever possible. But for objects with unknown sizes, or when they are too small to be scaled, some default minimum symbol size must be used. But the optimum (or acceptable) minimum size can vary greatly depending on the characteristics of the display device and personal preference of the user. So we have made this value selectable.

Note also the availability of certain symbols whose size will be scaled according to the magnitude of the object, rather than its angular size.

2.7.4 Miscellaneous Options

Here are some additional customization options:

- The cursor style can be changed (Section 11.5 on page 101).
- The format used for displaying dates, times (Section 11.8 on page 102) and celestial coordinates (Section 11.4 on page 101) is selectable.
- A Readout Bar, containing information about the current field, can be displayed (Section 4.9 on page 37). Its contents can be selected as well.
- The Caption Bar can contain the reference date and time in various formats: Local, Universal, and Sidereal Time (Section 4.10 on page 37).

- The Status Bar can be removed from the window.

2.8 Tools for Observing Preparation

For most observers, the time that is available for using the telescope is limited and therefore very valuable. Many of us have to travel a considerable distance to get to a dark site. So we want to make the most of our observing time, and that means doing some planning beforehand. MegaStar provides some tools to help you plan your observing session.

2.8.1 Choosing Your Targets

The first step is to choose the objects that you want to observe. MegaStar's **DSO Utility** (Section 6.9 on page 56) can be very useful, enabling you to list the objects in MegaStar's database with various filters applied. For example, limiting the RA and Dec will ensure that only objects that are above the horizon will be listed. Perhaps you only want to consider objects that are well within the limiting magnitude of your telescope. Or maybe you enjoy hunting those "challenge objects" at the limit of your telescope's capability. Perhaps your primary interest is planetary nebulae or globular clusters. The filter options can accommodate all of these needs.

When you have an object list displayed, you can double-click on an entry to display it in the field. There are also options to print the list or save it to a special file called an "Observing List" file.

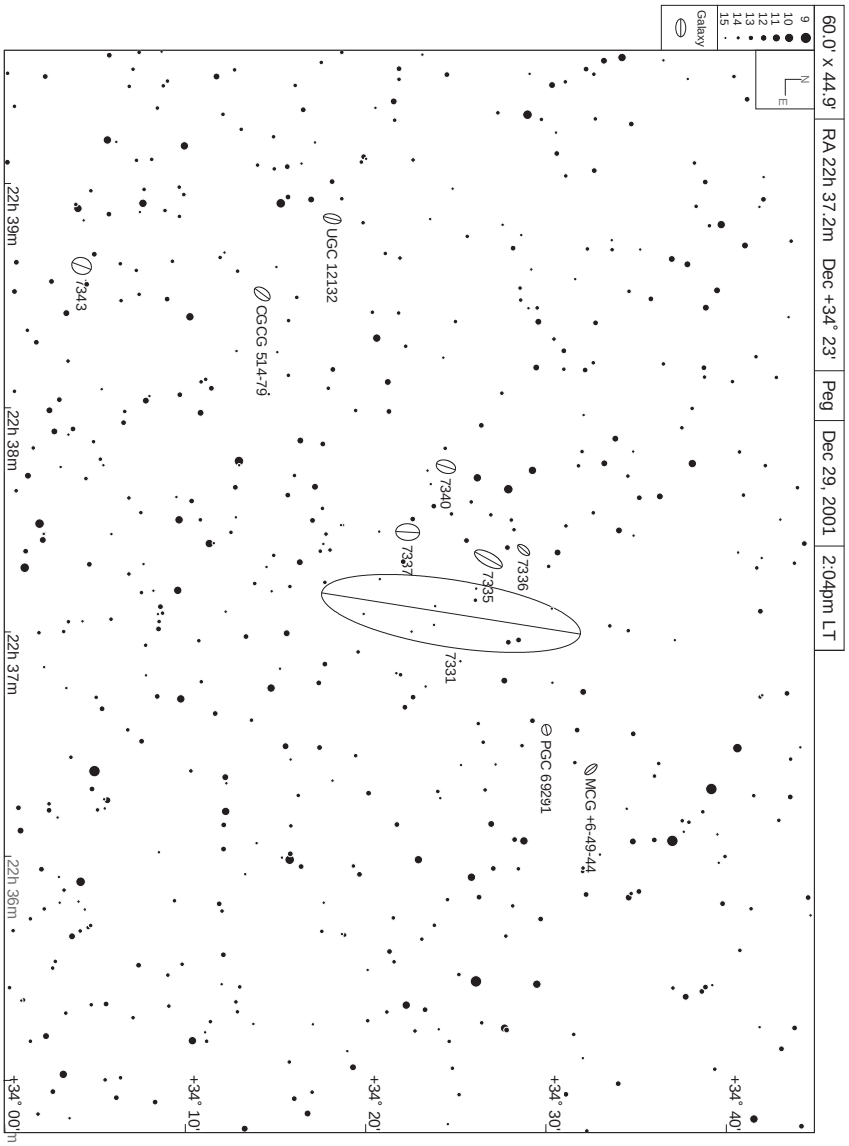
2.8.2 Observing List

With MegaStar's Observing List feature (Section 10.4 on page 94), you can compile all of your target objects into one convenient file. The list can be displayed in a separate window, and you can quickly locate the objects by double-clicking on their entries. You can also click the "Show These DSOs Only" option so that only those objects in the list will be plotted. This allows you to see all of your targets, uncluttered by extraneous objects.

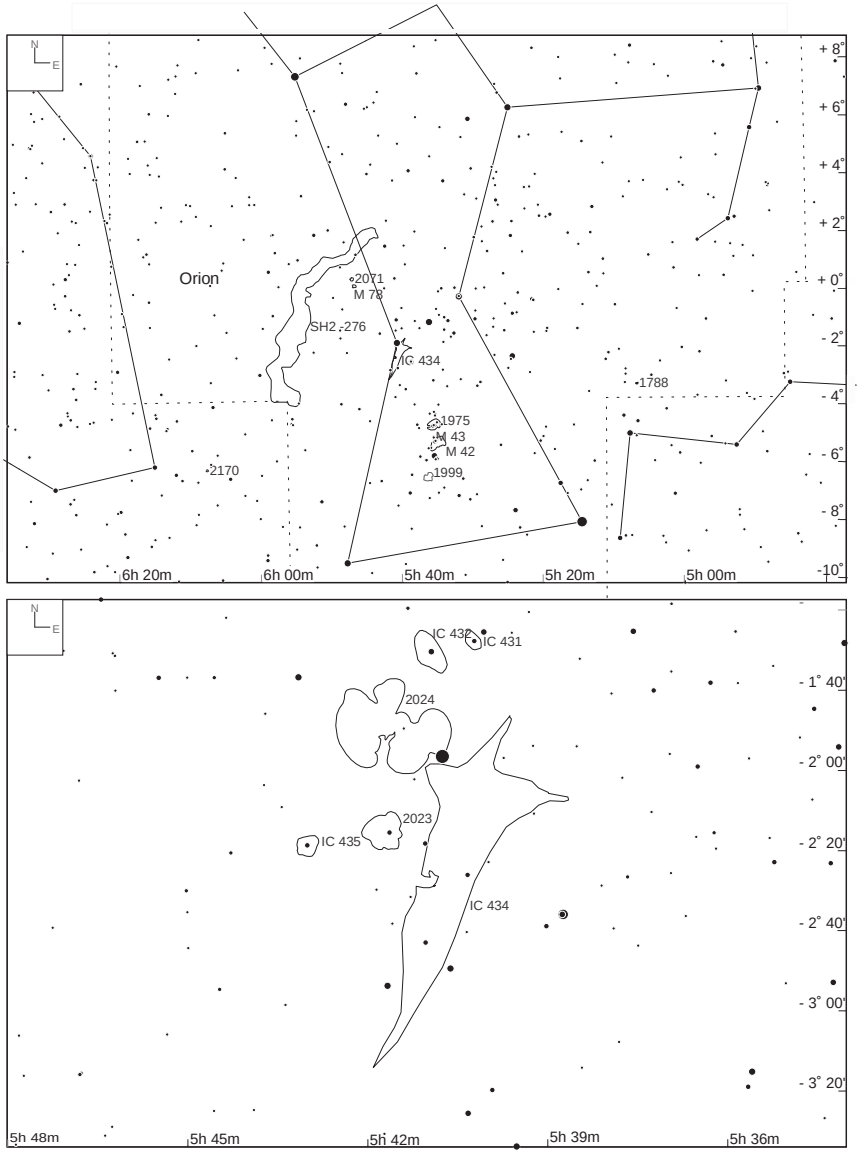
2.8.3 Printing Charts

If you aren't going to be using a PC at your observing site, then you'll probably be printing finder charts (Chapter 3). For this, MegaStar's multi-chart capability can be a useful feature. This enables you to print up to four different charts on a single page. One of the charts could be a wide-field view for use with your finder or Telrad. Another chart could be a close-up view for use at the eyepiece. With the "quad chart" feature, you could have a wide-field view and close-ups of three different objects, all on the same page. Some sample charts are shown on the pages that follow.

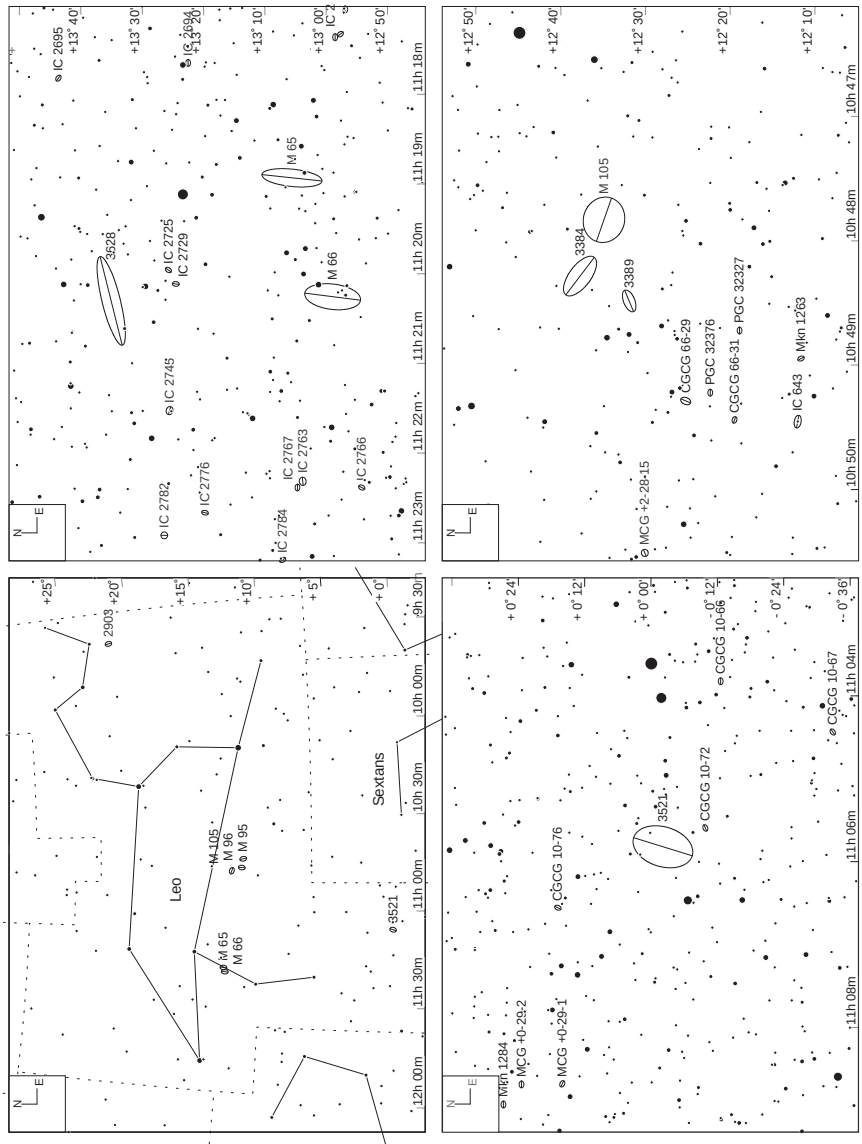
The **DSOs | Screen Listing** function (Section 6.8 on page 56) will display a list of all the DSOs in the currently displayed field. This is a convenient way to get a data printout of all of the objects in the field of a printed chart.



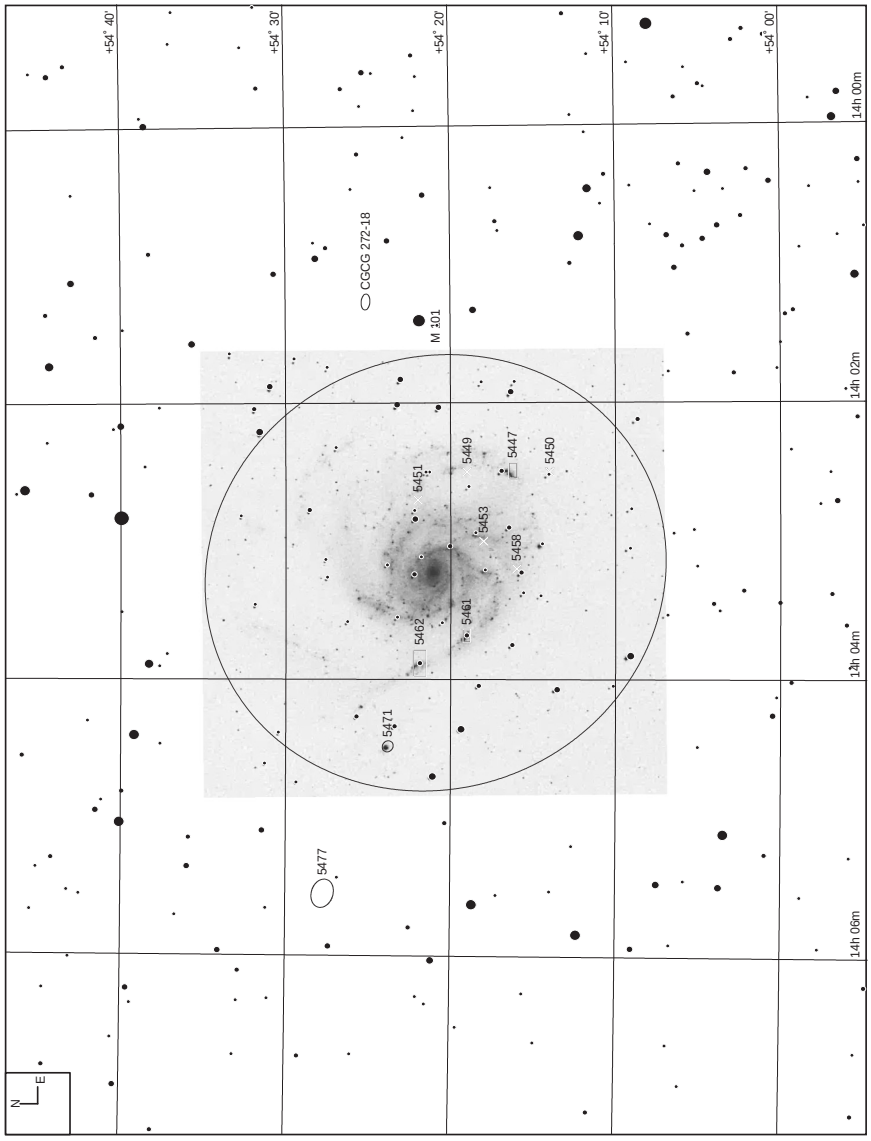
Sample chart printed from MegaStar using the Full-Page mode. This chart was printed on standard letter paper 8.5 by 11-inches. MegaStar scales maps to fit your paper source—so if your printer allows larger sizes, like legal or taboloid or smaller sizes like A3, A4 or A5 MegaStar will appropriately scales the maps to that page size.



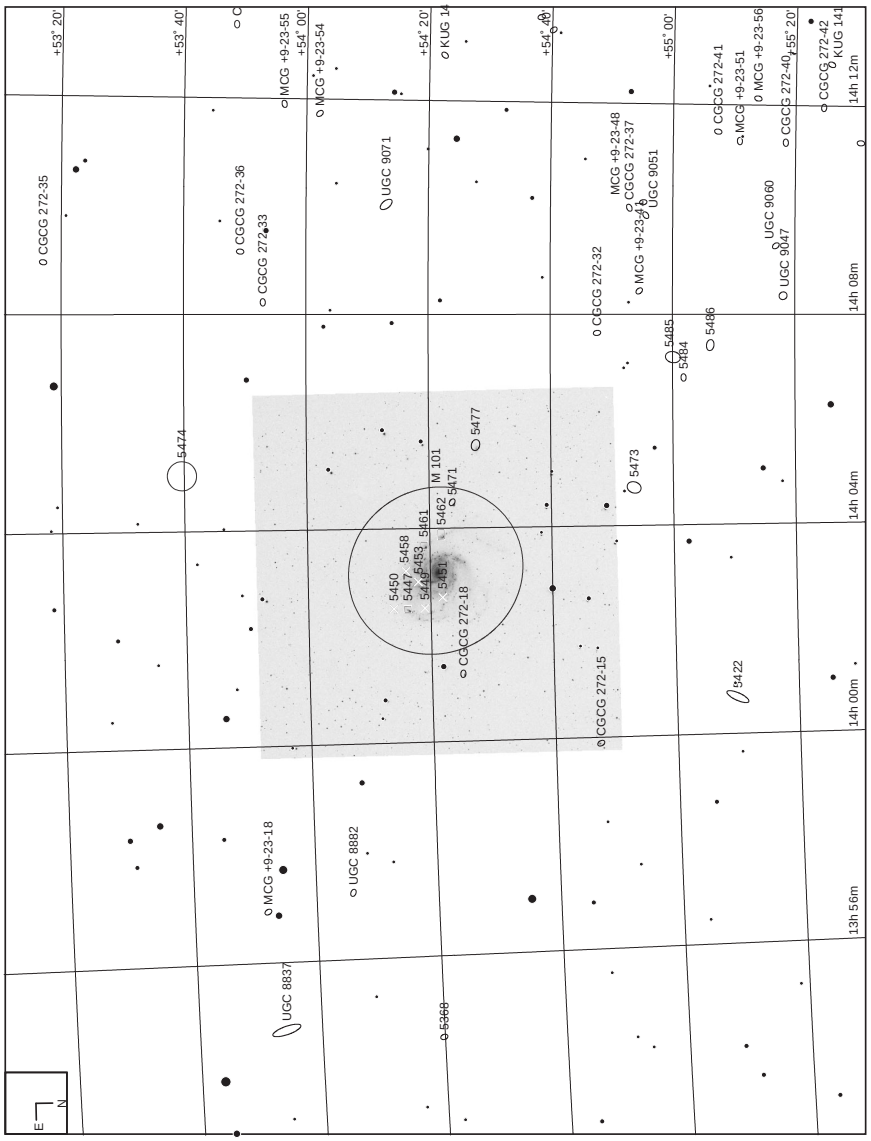
Sample chart printed from MegaStar using "Double Chart" mode (Section 3.4 on page 29). MegaStar scales maps to fit your paper source—so if your printer allows larger sizes, like legal or taboloid or smaller sizes like A3, A4 or A5 MegaStar will appropriately scales the maps to that page size.



Sample chart using "Quad Chart" mode (Section 3.4 on page 29). MegaStar scales maps to fit your paper source—so if your printer allows larger sizes, like legal or taboloid or smaller sizes like A3, A4 or A5 MegaStar will appropriately scales the maps to that page size.



This chart of M 101 includes one of the 78, 800 ditital images (thumbnail) that are distributed with the MegaStar5



This chart of M101 includes a Digitial Sky Survey image at 10x that was downloaded over the Internet from the Space Science Institute.

2.9 Using MegaStar at the Telescope

MegaStar has a number of features designed to enhance its use in the field.

2.9.1 Night Vision Mode

Probably the most obvious feature for field use is the Night Vision mode (Section 11.6 on page 102), which produces a monochrome display. Ideally, this would limit all of the screen colors to shades of red. However, Windows does not lend itself to this, because certain screen components will not change. Most people place a red filter over their PC screen to eliminate this problem. In that case, many find that it is preferable to use MegaStar's option of selecting white or gray as the monochrome color, since this can result in superior contrast.

2.9.2 Field of View Overlays

There are four types of overlays which enable you to simulate or represent fields of view.

Eyepiece Field

If you want to know how a field is going to look in the eyepiece, you can draw a circle representing the field of view of a particular eyepiece (Section 9.1 on page 81). Plotting multiple eyepiece circles can aid in star hopping. Also, you can determine if there are any secondary objects in the same field as your primary target.

The eyepiece overlays are equally useful if you are bringing printed charts to your observing session, since these circles can be printed on the chart.

CCD Frame

The CCD (or film) frame overlay can be useful in acquiring your target for imaging (Section 9.4 on page 85). The stars can be used as a centering aid, and you can determine how well the object will fit in the frame. If your imaging device can be rotated, the ability to rotate the frame in MegaStar will help determine the optimum orientation.

If you have an off-axis guider system, MegaStar can simulate the position of the guider image as well. This can be extremely useful in locating a suitable guide star.

Finder and Telrad Fields

If you are using a finder or Telrad, you can plot or print these overlays on the chart to aid in star hopping.

2.9.3 Reducing Keyboard Use

A common problem experienced in the field is difficulty seeing the keyboard in the dark. MegaStar has some features which minimize the need to use the keyboard.

For example, some of MegaStar's dialog boxes contain buttons which can be used to replace key presses. If you look at the "Locate" dialog box, you will see that an object name can be "typed" using only the mouse. Some of the magnitude filter dialog boxes have convenient preset values which can be selected using the mouse.

The Command Window (Section 4.4 on page 33) can also be useful, since it gives you the convenience of using hot keys without needing to use the keyboard.

The Context Menu (Section 4.6 on page 34) also provides a convenient way of

executing commonly used commands without using the keyboard.

2.9.4 Observing List

With the Observing List (Section 10.4 on page 94), you can quickly locate the objects that you have previously selected for observation. The Observing List window can be kept open throughout the observing session. The "Flag" function lets you keep track of which objects you have observed. The **Show Observing List Only** option (Section 6.1 on page 49), which can be quickly toggled on and off, will plot only your target objects, without displaying any extraneous DSOs.

Another feature, somewhat related to this, is **Show Target Object Only** (Section 6.1 on page 49). This can be a useful feature that is often overlooked by users. Here is how it works: You select an object to be your current target using the data box context menu (Section 13.8 on page 121). Then when you turn on the "Show Target Object Only" option, that DSO will be the only one displayed. And it will always be displayed regardless of field size, even if that object is normally only plotted when the field is five degrees or less. With this option, you can display a 90-degree field to orient yourself to the target for initial star hopping. Then you can zoom in as your search narrows. With only that one object displayed, you won't be distracted or confused by other objects in the field. You can quickly return to the normal display by toggling the option off in one of several ways: From the "DSO Database Options" dialog (Section 6.1 on page 49), by clicking the toolbar button (Section 6.10 on page 60), by clicking a hot key (Section 4.8 on page 35), or by including that command in the context menu (Section 4.6 on page 34) or Command Window (Section 4.4 on page 33).

2.9.5 Quick Field Changes

Unless your telescope has digital setting circles, you probably find objects by star hopping. Normally, one starts with the "big picture" of the sky before narrowing the search to a small field. The **Preset Field Size** feature lets you quickly toggle between large and small fields (Section 8.6 on page 78). As with most other commands, you have great flexibility in how the command is executed: menu, hot key, toolbar, command window or context menu. Using the **Zoom/Preset Options** dialog box (Section 8.7 on page 78), enter the Preset 1 and Preset 2 field sizes. Then simply execute the **Go To Preset Field Size 1** or **2** command to view that field.

An even more flexible way to switch fields, which is convenient to use in the dark, is the **Save/Restore View** feature (Section 3.1 on page 27). As you are preparing for your observing session, when you find a field that you want to observe, you can save that field for quick retrieval later (giving it a name or a title). When you are ready to observe that object, just click on that view from the list to display it. The saved view will retain most of the program settings that were selected at the time it was saved (field size, filter settings, orientation, etc.). This feature has other applications as well. You can set up any number of predefined program configurations involving filter settings, active databases, symbol selections and other options. A saved configuration can be quickly restored at any time.

2.9.6 Telescope Interfaces

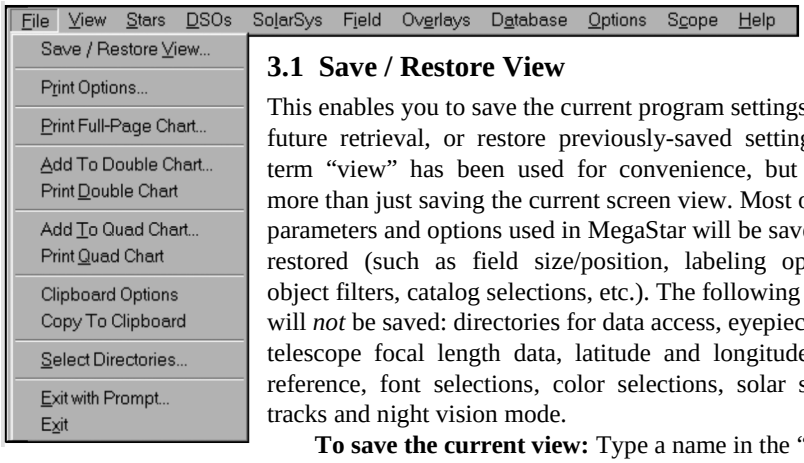
Perhaps the most obvious application of MegaStar at the telescope is its ability to interface with many popular computerized mounts and digital setting circle devices (Section 12.1 on page 105). The specific capabilities that are available will depend on the type of interface.

For most interfaces, you will be able to display a marker on the field that indicates where the telescope is pointing (Section 12.4 on page 107). For hands-free operation, you can tell MegaStar to "lock on" to the telescope position, so that the field will automatically follow the telescope's movement. This marker can be used in conjunction with the Eyepiece Overlay feature to simulate the view that is currently in the eyepiece.

For systems that support a "go to" function, you can quickly select a target in MegaStar and slew the telescope to that object (Section 12.14.2 on page 113).

MegaStar also has a "Local Sync" feature that will enhance the accuracy of your digital setting circles (Section 12.8 on page 110).

Chapter 3. File Menu



3.1 Save / Restore View

This enables you to save the current program settings for future retrieval, or restore previously-saved settings. The term "view" has been used for convenience, but this is more than just saving the current screen view. Most of the parameters and options used in MegaStar will be saved or restored (such as field size/position, labeling options, object filters, catalog selections, etc.). The following items will *not* be saved: directories for data access, eyepiece and telescope focal length data, latitude and longitude, time reference, font selections, color selections, solar system tracks and night vision mode.

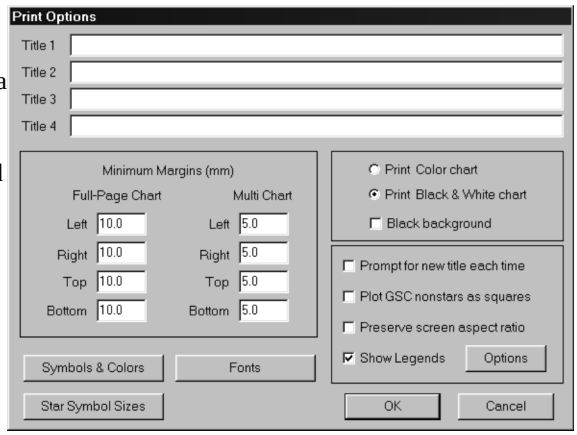
To save the current view: Type a name in the "Add a new view" section of the dialog box, then click the "Save" button. The name you type must conform to the rules for creating file names. Most alphanumeric characters (and embedded blanks) are permitted.

To display a saved view: Highlight the desired name in the list, then click the "Display" button. Alternatively, you can simply double-click on the desired name.

To delete a saved view: Highlight the name in the list, then click the "Delete" button.

You can create as many views as you like. For example, you could create a view for which the program settings are optimized for working with double stars, another for deep sky objects, and another for solar system objects. Or you can simply save an interesting field that you woud like to come back to later. This a powerful feature that can have many different applications.

3.2 Print Options



Titles—Up to 4 lines of text can be entered, with a maximum length of 100 characters per line. Note: These lines will be printed on full-page charts only.

Minimum Margins— These are specified in millimeters and are in addition to any default margins that the printer may impose. Most printers will not print

to the very edge of the paper. The actual margins may be much larger if the "Preserve Screen Aspect Ratio" option is selected, since this will constrain the size of the chart in one of the dimensions.

Print Color chart / Print Black & White chart—In order to print a chart in color, "Print Color chart" must be selected (even if your printer is set up to print in color by default).

Black Background—Prints a chart having a black background. This is not recommended.

Prompt for Title Each Time—If selected, a dialog box for entering a chart title will be displayed automatically each time you choose "Print" from the menu.

Plot GSC nonstars as squares—Causes GSC nonstars to print as squares, in order to distinguish them from stars on monochrome charts. Note, however, that the vast majority of objects classified as "nonstars" in the GSC are in fact stars.

Preserve screen aspect ratio—This will force the printed field to have the same angular dimensions as the field on the screen (the printed chart will have the same "shape" as the screen display). If not selected, the field height or width will be expanded to fill the available space on the page (taking the minimum margins into account).

Show Legends—This will enable legend information to be plotted on the chart. Note that only full-page charts can print legend information. No legends will be printed on multi-charts. The contents of the legend is selected by clicking the "Options" button. Most of these options are self-explanatory. The "Data Box" option will print the DSO data box if one is displayed on the screen when the chart is printed.

Symbols & Colors—This displays a dialog box for selecting the properties of object symbols and lines. See **Section 11.2 on page 100** for a detailed description of this dialog box.

Fonts—This button displays a dialog box for selecting the fonts and colors of various text items.

Star Symbol Sizes—A text box is provided for each magnitude symbol (0 to 15), where the size of the symbol can be specified in millimeters. A legend will be drawn on the screen showing the relative sizes of the star symbols. Note that this legend is *not* intended to depict the actual sizes as they will appear on the printed chart. The resolution of a monitor is not adequate to accurately represent the printed symbols. This legend is only intended to show the *relative* diameters of the star symbols.

Buttons are provided for increasing or decreasing the diameter of all symbols in steps of 10%.

At any time, either the "default" or the "currently used" values can be reloaded.

The symbol sizes can be automatically rescaled, using the size of the smallest symbol as the starting point. Each successively larger symbol size will be computed as follows:

diameter = (dp * 1.05) + (0.5 * ds)

where dp = diameter of previous (next smaller) symbol,
ds = diameter of smallest symbol.

This will generally give an acceptable range of sizes.

The width of the border (a white ring in the case of black stars) can be specified. This helps to resolve overlapping stars.

The "Print Sample" button will print a sample legend showing the "new," "current," and "default" symbols.

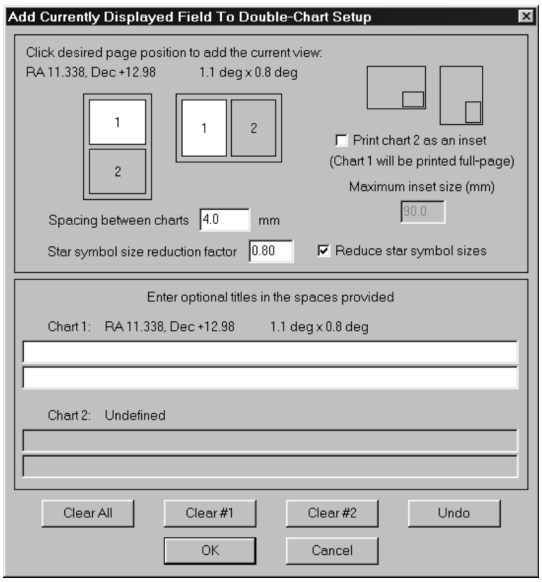
3.3 Print Full-Page Chart

A standard Windows Print dialog box will be displayed. The "Properties" button allows you to select landscape or portrait mode, along with other print options.

The chart that MegaStar prints will have the same characteristics as the field on the screen. Almost all of the options selected for the screen display (except fonts and colors) will be reflected in the printed chart.

3.4 Add To Double Chart and Add to Quad Chart

Note: The dialog box shown here is for a Double Chart setup. The dialog box for a Quad Chart setup is similar, with the following differences: You can choose one of four chart positions; there is only one title line per chart; and there is no option to print one of the charts as an inset.



To print two or four charts on the same page, use these functions to choose the placement of the chart. Each time this dialog box is opened, you can only make one placement selection, which will be for the chart of the field that is currently displayed on the screen.

Click on one of the rectangles containing a number to select the placement. That box, which is gray when undefined, will turn white. The center coordinates and field size of the chart will be displayed in the lower half of the dialog box. **Note:** The "portrait" and "landscape" rectangles are not used to select the orientation of the chart. They merely indicate what that chart position will be when printed in that orientation. You must still select the desired orientation from the Windows "Print" dialog box.

After you have selected the position, you can enter a title for that chart in the cor-

responding text entry box. If this field is left blank, the space normally reserved for a title will be used for the chart area, thus maximizing the size of the chart.

The following options and commands are provided:

Spacing between charts —Enter the space in millimeters between adjacent charts.

Star symbol size reduction factor—When multiple charts are printed on the same page, the resulting compression of the chart may make the star symbols appear out of proportion. To compensate for this, a star symbol reduction factor can be specified. In order for this reduction factor to be applied, make sure that the **Reduce star symbol sizes** option is checked.

Print Chart 2 as an inset—This option is only available for the Double Chart setup, not the Quad. Chart 2 will be printed as an inset, with Chart 1 being printed full-size. The size of the inset chart is specified under **Maximum inset size**.

Undo—If you choose a chart position and then want to change your mind, this button will clear that selection.

Clear All—TClears all current selections. Each time you open this dialog box, the previous chart selections will be retained . This lets you start fresh with a blank page.

Clear 1, Clear 2—Clears only the specified chart position.

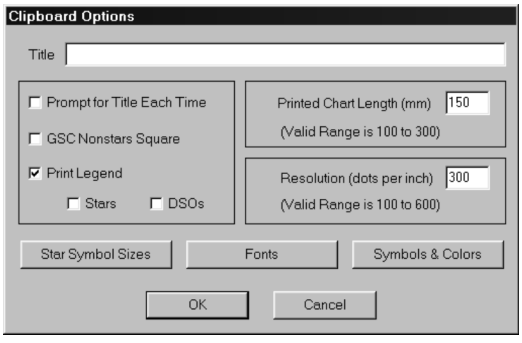
After a chart has been defined for Double or Quad use, it will be saved as a "view" (Section 3.1 on page 27). The views will be named "chart 1 of 2", "chart 2 of 2", "chart 1 of 4", etc. So if you want to review what the field for a given chart looks like, you can go to "File | Save/Restore View" and redisplay that field. This can also be useful for recreating a Double or Quad chart setup in a future session, since these views will persist until they are overwritten (even after you exit MegaStar).

3.5 Print Double Chart and Print Quad Chart

After you have used the above functions to define the charts you want to print, these commands will print the Double or Quad charts. Note that you do not need to define all of the charts in the Double or Quad setups. You may leave one or more positions blank (undefined). This may be useful if you want to have a blank area on the page for writing notes or making sketches.

3.6 Clipboard Options

The Copy to Clipboard options are similar to the Print options, except for the following additional items:



Printed Chart Length—This value should be set to the approximate size that the exported chart will have when it is printed. This will aid in the proper rendering of the chart

when it is imported into documents.
Resolution—This value should be set to the printer resolution that will be used for printing the exported chart.

3.7 Copy to Clipboard

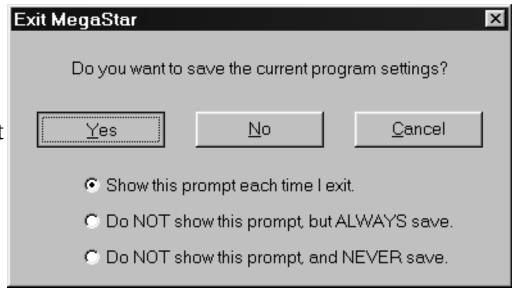
This command places a chart of the current field into the Windows clipboard. The clipboard image can be imported into word processing and desktop publishing software.

3.8 Select Directories

This tells MegaStar where to access the GSC data, non-GSC stellar data and thumbnail image file. Be sure to specify both the drive and the directory. In the case of the thumbnail image data file, include the file name ("thumbnail.dat") as well .

The "Browse" buttons allow you to inspect and navigate the directories of your hard drive(s).

3.9 Exit with Prompt and Exit

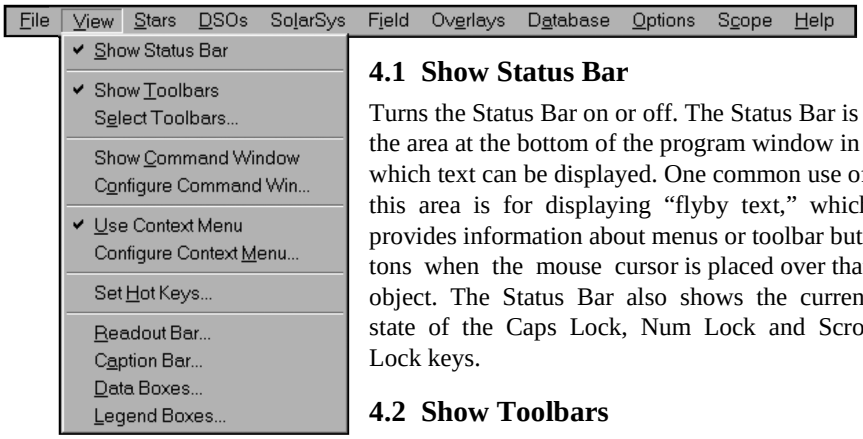


There are two commands in the file menu for exiting MegaStar. "Exit With Prompt" will display a dialog box which allows you to choose whether or not you want to save the current program settings (such as current field size, position, filtration, etc.).

If you do not want to see this dialog box every time you exit, you can select one of the two options at the bottom the dialog box. One option will always automatically save the settings, and the other will never save the settings. Then if you close the program using "Exit" (instead of "Exit with Prompt"), the program will close immediately without displaying a dialog box. The settings will either be saved or not, depending on what you chose as the default action. If you ever change your mind as to what the default action should be, or to override it for the current session, use "Exit with Prompt" to display the options dialog box.

Note that if you are in night vision mode, you do not have to change back to color mode before exiting. MegaStar will automatically restore the system colors when the program terminates.

Chapter 4. View Menu

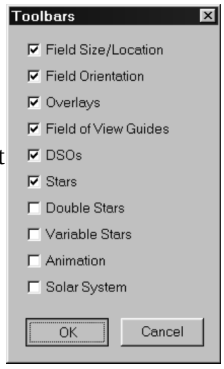


4.1 Show Status Bar

Turns the Status Bar on or off. The Status Bar is the area at the bottom of the program window in which text can be displayed. One common use of this area is for displaying "flyby text," which provides information about menus or toolbar buttons when the mouse cursor is placed over that object. The Status Bar also shows the current state of the Caps Lock, Num Lock and Scroll Lock keys.

4.2 Show Toolbars

Turns the toolbars on or off. The toolbar configuration (selections and positions) will not be affected by turning them off and on using this command.

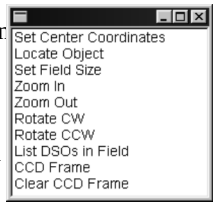


4.3 Select Toolbars

This dialog box lets you choose which toolbars to display.

Note: If you remove a floating toolbar by clicking the "x" in its caption bar, MegaStar will not be able to detect that action. The "Select Toolbars" dialog will no longer correctly reflect the current display state of that toolbar. It will indicate that the toolbar is displayed, even though it is not. Therefore, it is recommended that you always use this function to remove unwanted toolbars.

4.4 Show Command Window

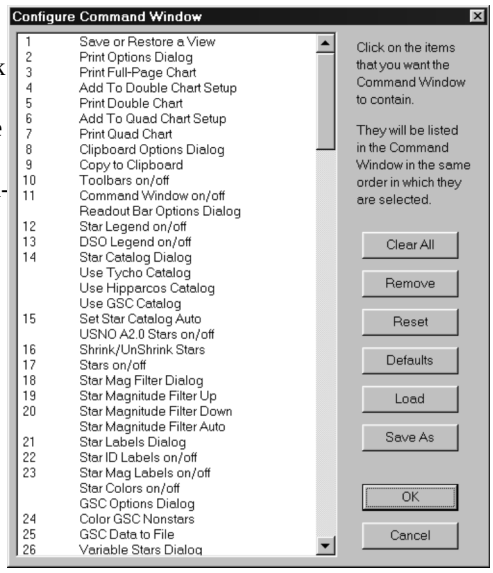


Turns the Command Window on or off. The Command Window is a dialog box containing a list of commands, providing an alternate means of executing those functions in MegaStar. Click on a command in the list to execute it.

When using MegaStar in the field, you may find that the command window is easier to use than navigating the main menus or typing hot keys in the dark. If you include only a few of the most frequently-used functions in this window, and make the font as small as possible, the screen space that it consumes can be reduced.

The following section describes how to select the Command Window contents.

4.5 Configure Command Window



Selects the contents of the Command Window. From the list of commands in the dialog box, click on the entries you want to include. The order in which commands are selected will determine their order in the Command Window. A number will appear to the left of the entry to indicate its position.

You can set up multiple configurations and restore them as needed (using the "Load" and "Save As" options described below).

Clear All—Clears all the selections and starts over with an empty list.

Remove—Clears the highlighted selection.

Reset—Restores the selections to what they were at the opening of the dialog box.

Defaults— Loads the default command window configuration.

Load—Loads a previously saved command window configuration. These will be saved in files having a file extension of ".cmdwin."

Save As—Saves the current configuration. A file selection dialog box will be displayed for entering the file name.

4.6 Use Context Menu

If this menu item is checked, then a context menu will be displayed when the right mouse button is clicked within the MegaStar field. A context menu works just like the program's main menu. However, this menu can be configured to contain only those commands that you want. The next section describes how to configure the context menu.

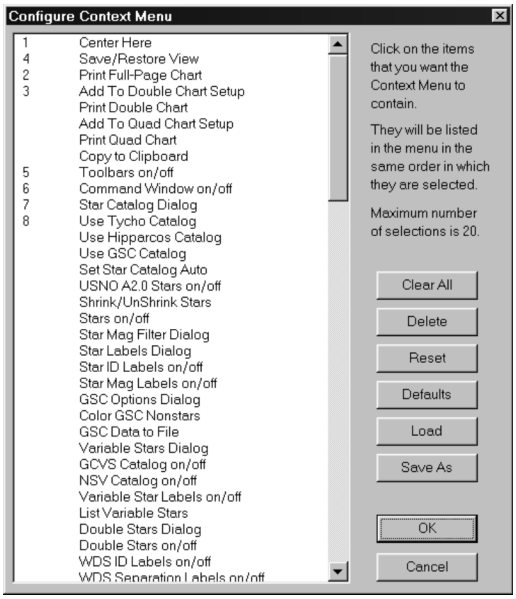
If "Use Context Menu" is unchecked, then the right mouse button will re-center the field at the current cursor position. It performs the same function as "Center Here" in the context menu, except it will happen immediately without displaying a menu.

4.7 Configure Context Menu

Selects the contents of the context menu. From the list of commands in the dialog box, click on the entries you want to include. The order in which commands are selected will determine their order in the context menu. A number will appear to the left of the entry to indicate its position. Note that a maximum of 20 commands may

be selected for the context menu.

You can set up multiple configurations and then restore them as needed (using the "Load" and "Save As" options described below). For example, you may want to set up one context menu for use when working with solar system objects, and another when working with deep sky objects.



Clear All—Clears all the selections and starts over with an empty list.

Remove—Clears only the highlighted selection.

Reset—cRestores the selections to what they were at the opening of the dialog box.

Defaults—Loads the default context menu configuration.

Load—Loads a previously saved context menu configuration. These are saved in files with an extension of ".context."

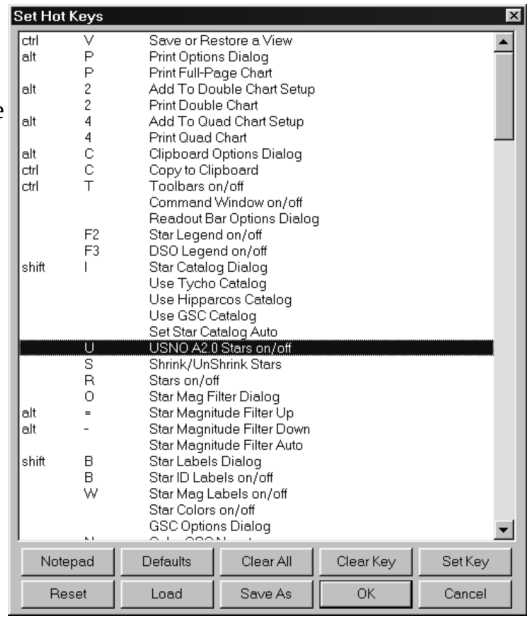
Save As—Saves the current configuration. A file selection dialog box will be displayed for entering the file name.

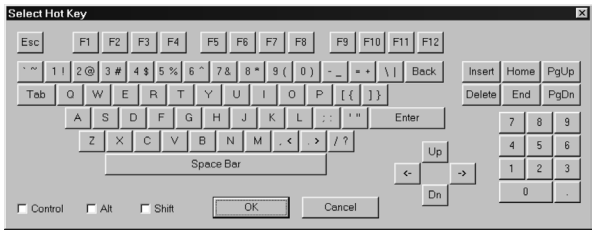
4.8 Set Hot Keys

For many people, hot keys are the most convenient means of executing functions. MegaStar extends the flexibility of hot keys by allowing you to assign your own keys to commands.

The Set Hot Keys dialog box lists all of the commands to which a hot key can be assigned. The current hot key settings are shown to the left of the commands.

To set or modify a hot key, click on the desired command, then click the "Set Key" button (or simply double-click an entry





in the command list). When you do so, a "keyboard" dialog will be displayed. Click the desired key on the "virtual keyboard" to assign it to that command, then click OK. If you want to include Control, Alt and/or Shift keys as part of the hot key, click those check boxes in the keyboard dialog before clicking OK. These can be added alone or in combinations (except you cannot use both <alt> and <control> together).

You can set up multiple hot key configurations and then restore them as needed (using the "Load" and "Save As" options described below). MegaStar provides configuration files which will make MegaStar's hot keys compatible (as much as possible) with some other charting programs. If you are accustomed to the hot keys of another program, click the "Load" button to see what configurations are available.

Note: The <alt> key has a special significance in Windows. It is normally used for activating menus, and in other system commands. For example, <alt>F4 is a standard Windows command for closing an application. If you choose an <alt>key combination in MegaStar, it may override a system function. For example, if you choose <alt>F as a hot key, then it can no longer be used to activate the File menu.

Set Key—Displays the keyboard dialog box for setting the hot key of the highlighted command. Double-clicking a command will produce the same action.

Clear Key—Removes the key assigned to the highlighted command.

Clear All—Clears all current hot key assignments.

Reset—Restores the selections to what they were at the opening of the dialog box.

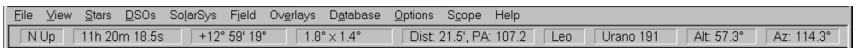
Defaults—Loads the default hot key selections.

Load—Loads a previously saved hot key configuration. These are saved in files having a file extension of ".hotkeys."

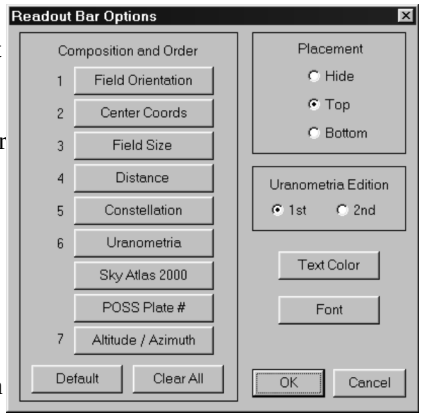
Save As—Saves the current configuration. A file selection dialog box will be displayed for entering the file name.

Notepad—The current hot key settings will be presented in a Notepad window. This will enable you to save the list to a file or print it for reference.

4.9 Readout Bar



The Readout Bar, which by default appears just below MegaStar's main menu, displays information about the displayed field. This dialog box allows you to customize the Readout Bar.



On the right side of the dialog, you can select the **Placement** of the Readout Bar and modify the **Font** and **Text Color**. There is also an option for choosing which edition of *Uranometria 2000.0* to use for computing the chart number of the field.

On the left side of the dialog box are buttons which correspond to the data items that the Readout Bar can display. The number to the left of a button indicates the item's position in the Readout Bar.

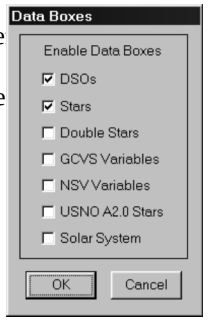
To select the contents of the Readout Bar, click the **Clear All** button and then choose the data items in the order that you want them to appear. You do not have to select every data item. Only select the ones you want the Readout Bar to contain.

The **Default** button will load the default composition of the Readout Bar.

4.10 Caption Bar

Click on the items that you want to display in the Caption Bar of the MegaStar Window. Note that when displayed in the Caption Bar, Local Time will be denoted as "LT," Universal Time as "UT" and Sidereal Time as "ST." (Do not confuse "ST" with "Standard Time"). The times will be updated once every minute.

4.11 Data Boxes



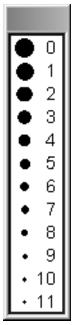
A Data Box is a window containing information about an object, which is displayed when you click on an object with the le mouse button. These data boxes can be enabled or disabled for various object types. See Chapter 13. on page 115 for more information about Data Boxes and a description of their contents for various types of objects.

When a data box is displayed, it can be dragged to any position on the screen (in the same way other windows are moved). Each time a new data box is displayed, it will be drawn at the same screen position as the previous data box. Also, these positions are "remembered" independently for each type of data box (DSOs, Stars, etc.).

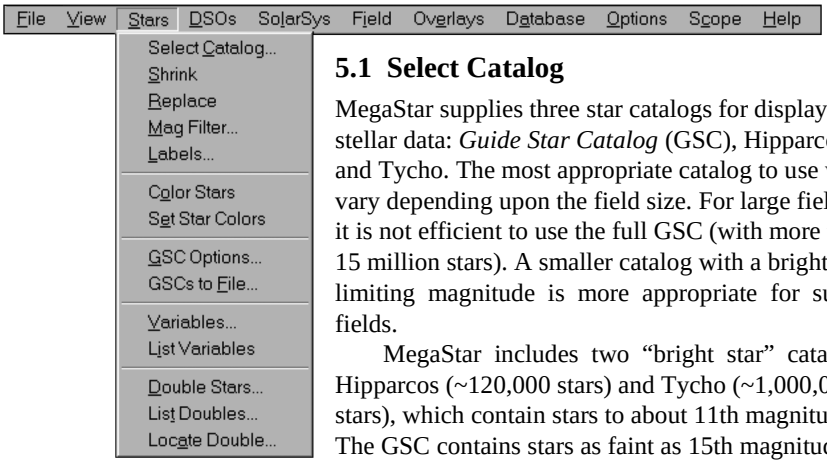
4.12 Legend Boxes

This dialog box lets you choose whether or not to display the legend boxes for stars and DSOs. The DSO legen shows the symbols that have been selected for deep sky objects, plus comets, asteroids and double stars. The Stars legend shows the magnitude associated with each of the star symbol sizes.

Note that the legend boxes can be moved to any location on the screen by dragging them, and they will retain their position (even between sessions).



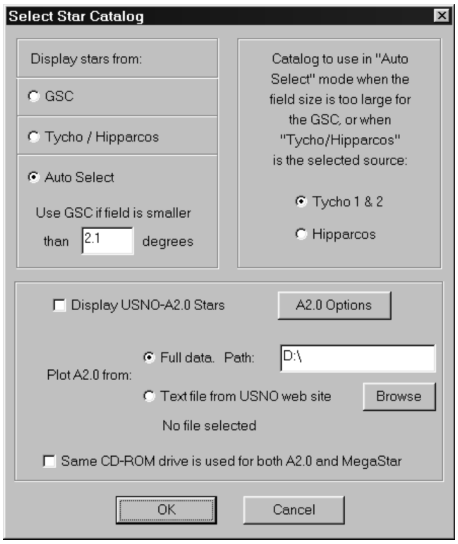
Chapter 5. Stars Menu



5.1 Select Catalog

MegaStar supplies three star catalogs for displaying stellar data: *Guide Star Catalog* (GSC), Hipparcos and Tycho. The most appropriate catalog to use will vary depending upon the field size. For large fields, it is not efficient to use the full GSC (with more than 15 million stars). A smaller catalog with a brighter limiting magnitude is more appropriate for such fields.

MegaStar includes two "bright star" catalogs: Hipparcos (~120,000 stars) and Tycho (~1,000,000 stars), which contain stars to about 11th magnitude. The GSC contains stars as faint as 15th magnitude. MegaStar also supports (but does not include) the US Naval Observatory A2.0 catalog, with about 526,000,000 stars to 22nd magnitude.



Normally, the star catalog selection should be set to **Auto Select**. For fields larger than a certain threshold size (2.1 degrees being the default), MegaStar will use either Hipparcos or Tycho. Whenever the field size becomes smaller than the threshold, the GSC data will be used. The selections at the upper right of the dialog box will determine whether Tycho or Hipparcos is used as the bright star catalog.

If you want to use a specific catalog for all field sizes, then you can disable Auto mode by selecting either **GSC** or **Tycho/Hipparcos** at the upper left of the dialog box. Be careful if you manually set the database to GSC. Large fields may take a long time to display, and become almost solid white with stars unless the magnitude is filtered. If you inadvertently select a large field with the GSC, you can hit the Escape key to terminate the drawing of stars (the response may not be immediate, however, and may not work with all CD-ROM drives).

It should be noted that quite often the GSC and Tycho/Hipparcos will disagree on the magnitude of a given star. This is primarily due to the fact that GSC magni-

tudes are *photographic*, whereas Tycho/Hipparcos magnitudes are *visual*.

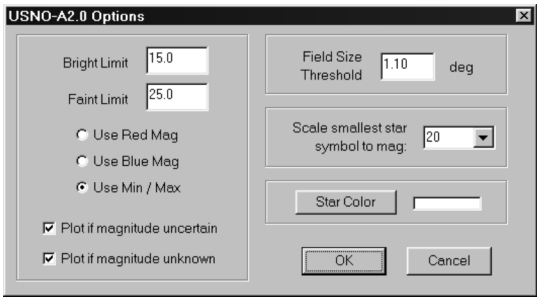
5.1.1 USNO A2.0 options

If you have the USNO A2.0 catalog, you can use this data in MegaStar. The A2.0 data is treated separately from the GSC, Tycho and Hipparcos data. In order to display these stars, you must click the **Display USNO A2.0 Stars** option.

Then you must tell MegaStar where the data is located. If you have the full A2.0 catalog, click **Full data** and enter the path to those files. They can be either on CD-ROMs or on a hard drive. You can also download text files of data for selected areas from the USNO web page at http://www.nofs.navy.mil/data/FchPix/cfra.html. In that case, click **Text file from USNO web site** and use the Browse button to select the desired file.

Indicate whether you are using the same CD-ROM drive for both MegaStar data and A2.0 data. This will help MegaStar handle the switching between CD-ROMs.

The "A2.0 Options" button provides additional options:



- **Magnitude filter range**.
- **Magnitude type selection**. Filtering can be based on the red or blue magnitude, or the extreme of either value.
- **Field size threshold**. This is similar to that used for the GSC. Only fields smaller than this field size will plot A2.0 data.
- **Star symbol scaling**. The smallest star symbol will be assigned to the magnitude value entered here. All stars fainter than this will use the same minimum symbol size. You should set this value to the faintest magnitude that you want to be able to distinguish. For example, if you are only interested in distinguishing magnitudes that are 20 or brighter, set this value to 20. MegaStar uses only 16 unique star symbols. So if (for example) you set the faint scale to 20, then all stars brighter than magnitude 5 will use the same symbol. When setting this value, you will have to consider the trade-off between magnitude "resolution" at the bright end and faint end of the magnitude symbol scale.
- **Star color**. You can choose to plot A2.0 stars in a different color from stars that are plotted from the GSC, Tycho and Hipparcos catalogs.

5.2 Shrink

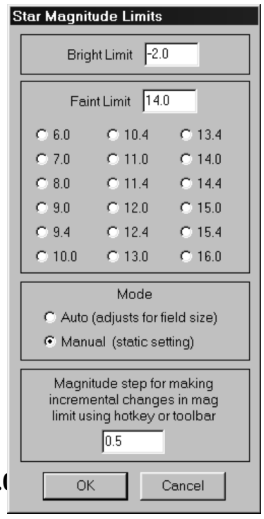
Choosing the "Shrink" option will cause all star symbols to shrink to 1 pixel. This is a toggle action, and the menu item will be replaced by "unShrink" (which will restore the stars to their normal symbol sizes).

Shrinking the stars can be useful when displaying large, dense star fields where small nonstellar objects can become hidden behind bright stars. Temporarily shrinking the stars may reveal these objects. It is also interesting to set the star catalog to GSC, and display "large" (20° or so) fields in the Milky Way. Many dark lanes can be seen using this technique. Try finding the "Celestial Dark Horse" centered at 17h 27m, −23° using a 20° field and a magnitude limit of 16.

5.3 Remove

This will remove the stars from the field. This also has a toggle action, and the menu item will change to "Replace."

5.4 Mag Filter



Normally, the stellar magnitude filter is set to **Auto**, which will automatically adjust the faint limit based on the current field size.

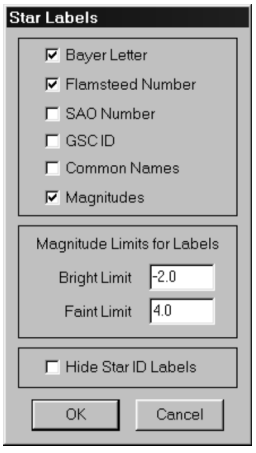
The Auto mode can be overridden, however, by selecting **Manual**. This will enable you set the star magnitude faint limit to a specific value, which will remain static. Several radio buttons with predefined values are provided for convenience.

If you switch from "Manual" to "Auto," the faint limit will be reset to the value that it would normally be for the current field size in "Auto" mode.

There are hot key and toolbar commands for adjusting the stellar faint magnitude limit. This dialog box provides a setting for the increment that these commands will use when increasing or decreasing the magnitude limit.

Note that these settings do not affect USNO A2.0 data. See Section 5.1.1 on page 40 for filtering A2.0 stars.

5.5 Labels



Stars can be labeled with their common name, Bayer letter, Flamsteed, SAO or GSC number, and magnitude.

Labels will only be displayed for stars whose magnitude falls within the specified filter range.

The sample above shows the positions of the various labels. Bayer and Flamsteed designations are displayed to the right of the star. SAO numbers or GSC IDs are at the upper left, and magnitudes are at the lower left.

Note that the magnitude labels are displayed to one decimal place (nearest tenth), with the decimal point omitted (e.g., “24” = “2.4”).

A “Hide Star ID Labels” option is provided. This will let you turn the labels off and on without altering the label selections.

5.6 Color Stars

When checked, stars will be plotted in color according to their spectral class.

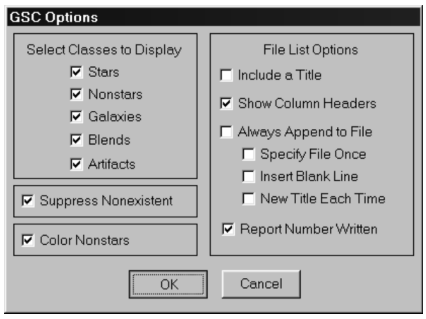
Note that the GSC does not contain spectral information, so this option will not have any affect when stars are plotted from the GSC. When the catalog selection is set to Auto mode, if the field size becomes smaller than the GSC threshold, star colors will disappear. Stars will only be colored when they are plotted from the Tycho or Hipparcos Catalog.

5.7 Set Star Colors

This dialog box lets you adjust the colors used for the various spectral class ranges. To set the colors, click on one of the buttons labeled “O,” “B,” “A,” “F,” “G,” “K,” or “M.” There are two buttons for each spectral type, corresponding to the subclasses “0-4” and “5-9.”

Note also that there is a different set of colors for the screen and printer. Click the “Screen” or “Printer” radio button to show or modify the color settings for that device.

5.8 GSC Options



Use this dialog box to select which classes of GSC objects to display, and choose options for the “GSCs To File” command.

Select Classes to Display—GSC objects are divided into the following classes: Stars, Nonstars, Galaxies, Blends and Artifacts.

The “Galaxies” class was only assigned to a few hand-entered errata, according to the GSC documentation.

“Blends” are images of close doubles where the separation of the components was made artificially small due to a centroider defect.

“Artifacts” are possible spurious images, such as diffraction spikes, which were digitized as objects.

Objects in the GSC were assigned the “Nonstar” class if there was any uncertainty that they were truly stars. But the majority of these appear to actually be stars, particularly in Milky Way regions. For example, look at the field of M11 with the “nonstars” colored. Almost all of the “nonstars” are true stars.

Color Nonstars—Displays all non-star types (including Blends and Artifacts) in the color selected for “GSC NonStar” in the “Options | Symbols & Lines” dialog.

Suppress Nonexistent—Suppresses the display of most GSC entries that coincide with objects in MegaStar's DSO database. Their original GSC classes were not altered, but they were flagged so that they could be identified and optionally hidden.

File List Options—These options are used in the "GSCs to File" command:

Include a Title—Prompts you to enter a title, which will be inserted at the top of the file.

Show Column Headers—Labels the data fields.

Append to Existing File—Multiple executions of "GSCs to File" will append the data to the file. If this option is not selected, an existing file will be erased and overwritten. This options has the following sub-options:

Specify File Once—You will be prompted to enter the file name only the first time this function is executed in a session. Subsequent data exports will be appended to this file.

Insert Blank Line—A blank line will be inserted before each appended list.

New Title Each Time—A new title will be inserted before each appended list (you will be prompted for a title each time).

Report Number Written—Select this if you want a message box to be displayed, reporting the number of GSC stars written. But if a GSC data box is on the screen (causing only that single star to be written), then the message box will not be displayed.

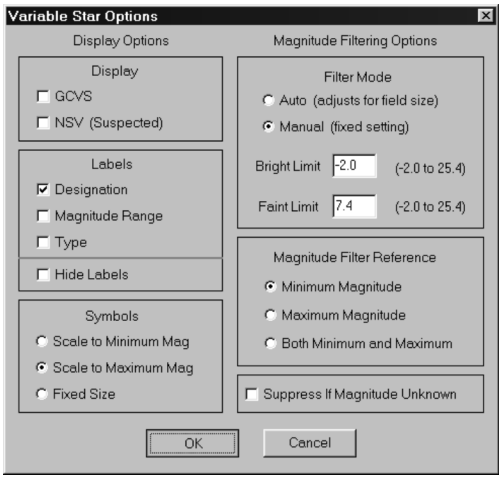
5.9 GSCs to File

This will dump GSC data to a file. A hot key command can be used to execute this function. A tabular listing of all GSC stars in the field will be produced, unless a GSC data box is currently displayed. If a GSC data box is on the screen, then only the data for that one star will be written. Double-clicking on a GSC data box with the right mouse button will also perform this function. The latter method is more suitable when you want to generate a list of selected stars. Be sure to select the "Append to Existing File" and "Specify File Once" options described above.

5.10 Variable Stars

The left side of this dialog box contains Display Options, and the right side contains Magnitude Filtering Options.

Display—Select the catalog(s) which you want to activate for displaying variable stars. GCVS is the *General Catalogue of Variable Stars*, and *NSV* is the *New Catalogue of Suspected Variable Stars*.



Labels—You can choose to label the variable stars with their designation, magnitude range, and/or type. The fonts and text colors can be selected using "Options | Fonts" in MegaStar's main menu.
Symbols—The variable star symbol can be scaled to the star's minimum or maximum magnitude, or a fixed symbol size can be used.
Filter Mode—There are several options for filtering variables by magnitude. A fixed range can be set, or you can let MegaStar automatically adjust the magnitude filter based on the current field size. Since there is a minimum and maximum magnitude associated with variables, you must specify which one to use as the reference for filtering. If "Min/Max Range" is selected, then both the minimum and maximum must fall within the magnitude filter range in order for the star to be displayed.

If **Suppress If Magnitude Unknown** is selected, variables with an unknown magnitude will not be displayed. The "Magnitude Filter Reference" setting will determine whether the minimum, maximum, or both will be checked for having an unknown value.

Additional Notes on Variable Stars:

Data Box. You can click on variable stars with the left mouse button to display a data window for that star. For a description of the data fields, refer to the files "gcvs.doc" and "nsv.doc" in the \docs directory of the CD-ROM. The conventions used in the original catalogs, such as the use of colons and parentheses, have been retained.

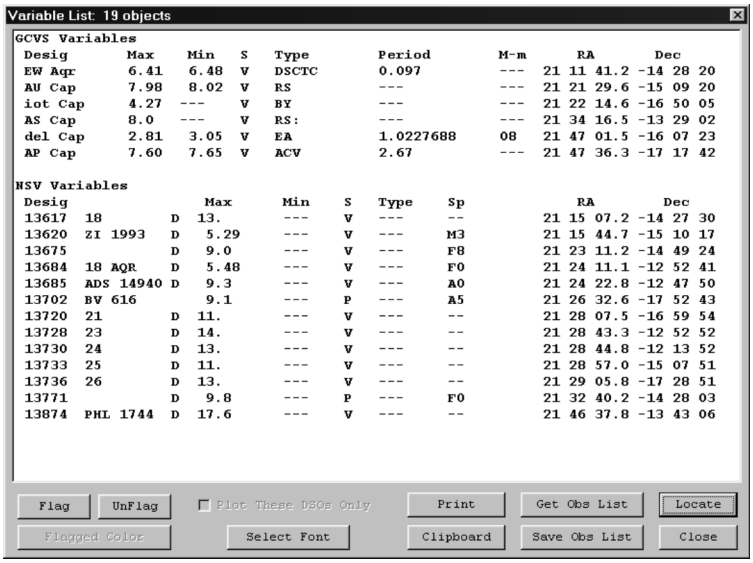
Locating Variables. The "Field | Locate Object" command can be used to find variable stars. For GCVS stars, type "vs" followed by the designation, including the 3-letter constellation abbreviation (e.g., "vs LL Lyr"). As with all other "Locate" operations, blanks are ignored and the text is not case sensitive. Thus the preceding example could be typed in as "vs ll lyr," "vslllyr," or "VSLLLYR."

To locate an NSV star, type "nsv" followed by the NSV catalog number (1 to 14811). Although the NSV catalogue does contain star designations, they will not be recognized by the "Locate" function. The designations in the catalogue are very inconsistent and awkward to use, and quite a few entries do not have a listed designation.

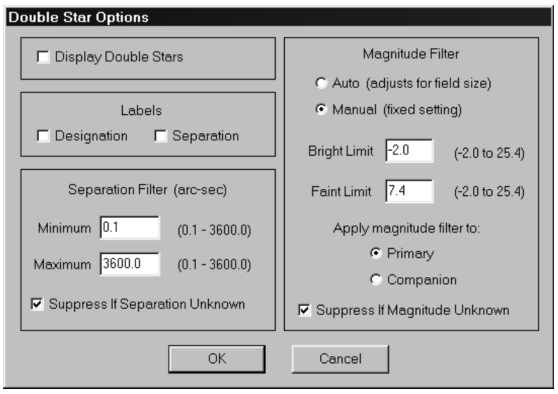
Note: No attempt has been made to correlate the variable star catalogs with any other star catalogs in order to suppress duplicate entries. Thus you will see the variable star symbol along with the normal star symbol from the GSC, Tycho or Hipparcos. The GCVS and NSV catalog positions do not appear to be extremely accurate, so there will be some discrepancies.

5.11 List Variables

This will display a scrollable window containing a tabular list of the variables that are currently displayed in the field. GCVS and NSV variables will be listed separately. Refer to Section 10.5 on page 95 for information about the options available in the Data Listing Window.



5.12 Double Stars

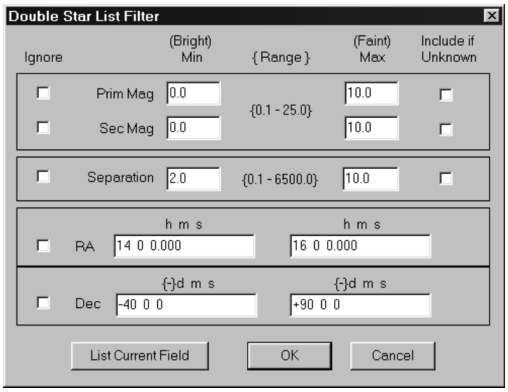


MegaStar uses the *Washington Catalogue of Visual Double Stars* (WDS) for displaying binary stars. This dialog box provides labeling and filtering options. No attempt was made to correlate the WDS with any other star catalogs in order to suppress duplicate entries, so you will see the double star symbols along with the normal star symbols from the GSC, Tycho or Hipparcos.

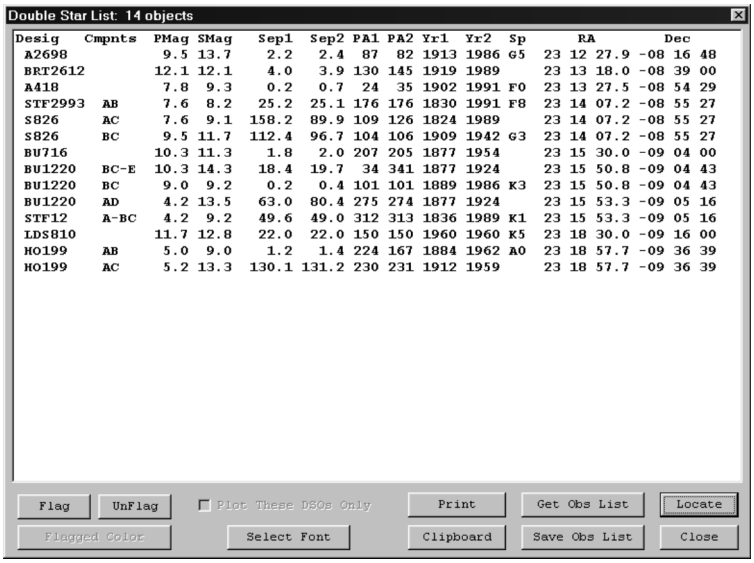
A data box is displayed when you click on a WDS object. Refer to Section 13.4 on page 120 for a description of this data box.

5.13 List Doubles

Use this function to generate a list of double stars. The dialog box has options for filtering the list by RA, Dec, Primary Magnitude, Secondary Magnitude and Separation. The “List Current Field” button will display a list of all the double stars in the current field.

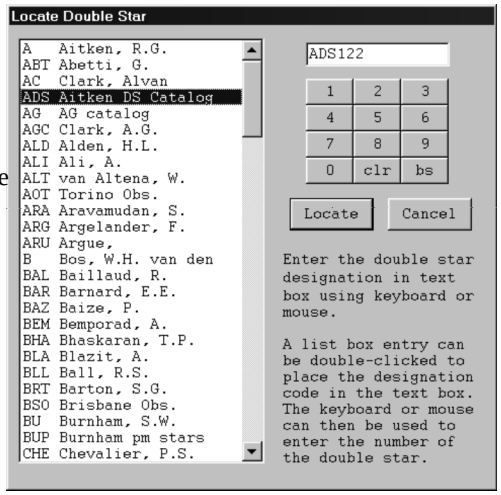


A sample output listing is shown below. Refer to Section 10.5 on page 95 for information about the buttons and options available in the Data Listing Window.



5.14 Locate Double

Many different catalog designations are used in the WDS. The "Locate Double Star" dialog box provides a list box of those names. To locate a double, you can type the designation directly into the text box (e.g., STF 9). Or double-click a list box entry to place the name in the text box for you, and then add the number.



5.15 Stars Toolbar

a b c d e f g h i j k l m

a. Show/hide stars (5.3).
b. Shrink star symbols to one pixel (5.2).
c. Show/hide spectral colors (5.6).
d, Show/hide designation labels (5.5).
e. Show/hide magnitude labels (5.5).
f. Increase magnitude filter faint limit (5.4).
g. Decrease magnitude filter faint limit (5.4).
h. Set magnitude filter to auto mode (5.4).
i. Set catalog to Tycho (5.1).
j. Set catalog to Hipparcos (5.1).
k. Set catalog to GSC (5.1).
l. Use catalog auto mode (5.1).
m. Show/hide USNO A2.0 stars (5.1.1).

5.16 Variable Stars Toolbar

a b c d e

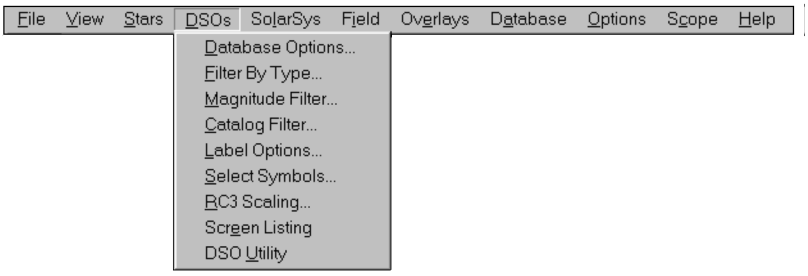
a. Show/hide GSCV variables (5.10).
b Show/hide NSV variables (5.10).
c. Show/hide variable star labels (5.10).
d. Locate a variable star (5.10).
e. Display a listing of all variables in the current field (5.11).

5.17 Double Stars Toolbar

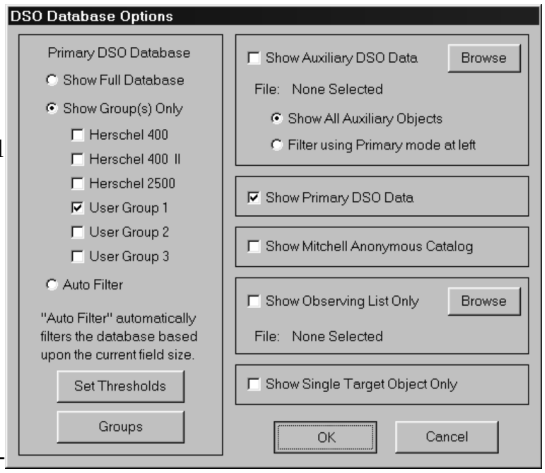
a b c d e

a. Show/hide double stars (5.12).
b. Show/hide designation labels (5.12).
c. Show/hide separation labels (5.12).
d. Locate a double star (5.14)
e. Display a listing of double stars (5.13).

Chapter 6. DSOs (Deep Sky Objects) Menu



6.1 Database Options



This dialog box allows you to manipulate MegaStar's three DSO databases. The **Primary** data is an integrated database of about 90,000 objects of all types. *The Mitchell Anonymous Catalog* (**MAC**) contains 117,000 objects (mostly galaxies). The **Auxiliary** database is used for adding your own objects to MegaStar, and will be initially empty. Section 6.9.3 on page 59 describes how to add objects to this database.

The right side of the dialog box has options for turning each of the three DSO databases on or off.

Display Auxiliary Data—After you have added objects to an Auxiliary DSO file (Section 6.9.3 on page 59), use this check box to turn the display of those objects on or off. Before activating an Auxiliary DSO file for the first time, you must select the file by clicking the "Browse" button. The name of the file that is currently active will be displayed below the check box. If **Show All Auxiliary Objects** is selected, no filtering will be applied based on the Auto Filter thresholds (Section 6.1.1 on page 51) or Group filter (Section 6.1.3 on page 53). **Use Primary Mode** will apply the same Group filters or Auto Filter mode that has been selected for the Primary data in the left side of the dialog box. When you add objects to the Auxiliary database, you can assign it a field size threshold, or add that object to a Group.

Show Primary DSO Data—This turns the Primary database on or off.

The Mitchell Anonymous Catalog (**MAC**) was created by Larry Mitchell shown here next to his 36-inch Obsession Dobsonian at the Texas Star Party in 2000. Larry started his catalog in the days when only Palomar Sky Survey prints were available. Several years ago, when the Digitial Sky Survey was published Emil Bonnano created a special version of MegaStar to automatically load and register those images against MegaStart's database where they could be visually checked and corrected, if necessary. Larry has devoted thousands of hours have been devoted to this effort.

Show Mitchell Anonymous Catalog—The MAC is a database of 117,000 galaxies which are not in the RC3 or original PGC catalogs. You may not want to display this catalog, since these are mostly faint objects visible only with large aperture telescopes (with some exceptions, depending upon the observer).

Show Observing List Only—An "Observing List" is a special type of file used by MegaStar to store a list of objects which you have compiled. This is described in Section 10.4 on page 94. This option will plot only the DSOs in your Observing List. This enables you see your targets without cluttering the field with extraneous objects. Since you can create multiple Observing Lists, a Browse button is provided for selecting the list you want to use.

Show Single Target Object Only—This will limit the display to one single selected DSO, regardless of the field size or filter settings. You may find this feature useful if you are using MegaStar at the telescope. At any field size, the chart will not be cluttered with other objects. To select a target object, locate (or left click) a DSO to display its data box. Then right click on the data box to display a context menu. One of the menu selections will be "Select for Single DSO." That object will then become the "target" object when this option is activated. You can change the target DSO as often as you want.

You will probably find that this feature is most useful when you can quickly toggle between Single Object Mode and normal mode. This can be accomplished by setting a hot key to toggle between the two modes, or by using the toolbar button for this function.

6.1.1 Auto Filter Mode

The left side of the dialog box provides some filtering options for the Primary Database.

If we always plotted the entire DSO database, large fields would be hopelessly overcrowded with objects and the charts would be unreadable. This is exactly what the **Show Full Database** option will do, and it should only be used for very special purposes. For example, you may want to depict the "zone of avoidance" in the Milky Way, or show the distribution of planetary nebulae in the sky. **Note:** Even when "Show Full Database" is selected, the other filtering options (magnitude, type and catalog) will still be applied.

Normally, you will want to select **Auto Filter** mode. This will automatically adjust the number of objects that are plotted based on the field size. When a large field (say, 80° or larger) is displayed, only the brightest and most prominent DSOs will be plotted (such as Messier objects). As you zoom in to smaller fields, fainter objects can be displayed without overcrowding the field. But filtering the database by magnitude alone is not really acceptable, since some "important" objects do not have a magnitude value in the database (particularly nebulae). Also, most large, faint objects are best depicted in a large field (for example, Barnard's Loop). Plotting only the brightest DSOs when the field is large would prevent some desired objects from

being displayed. To solve this problem, and increase MegaStar's flexibility, the following method for depopulating the database in Auto Filter mode was devised:

MegaStar defines 8 field size thresholds:

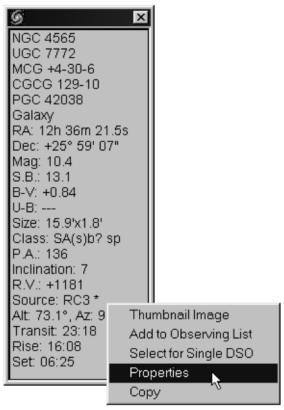
1: < 5°	5: < 40°
2: < 8°	6: < 60°
3: < 12°	7: < 80°
4: < 20°	8: Any Field Size

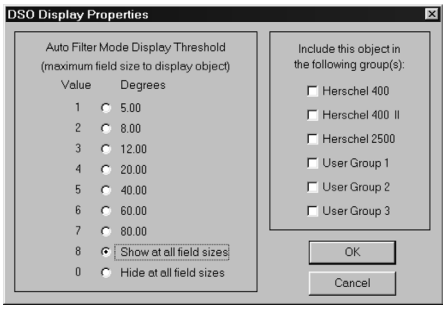
Each object in the DSO database is assigned a number from 1 to 8, which determines when that object will get displayed. For example, if an object has a threshold value of 5, then it will be displayed whenever the field size is less than or equal to 40 degrees (this is the field size cutoff for threshold 5). An object with a value of 1 will only be displayed if the field is 5 degrees or smaller. Zero is also a valid threshold assignment, and in that case the object will *never* be displayed, regardless of the field size. This is the mechanism for "deleting" an object from the database.

6.1.2 Changing a DSO's Auto Filter Threshold

MegaStar allows you to change the assigned threshold value for an object. Suppose you have a favorite object, and you want it to always be displayed at any field size. But it currently only has a threshold value of "4" in the database, so it only gets plotted when the field size is less than 20°. What you need to do is change that threshold to "8". Here's how:

Left click on the object to display its data box. Then right click on the data box to





display the context menu, and choose "Properties."

In the Properties dialog box, you can select the desired Display Threshold, assigning it any value from 0 (effectively deleting it) to 8 (making it always visible at any field size). In addition, you can assign that object to any (or all) of the three Herschel groups or the three user-defined groups (described in the next Section).

The field sizes which are assigned to the threshold values 1 through 8 can also be modified. Suppose you want objects with a threshold of 1 to only be displayed if the

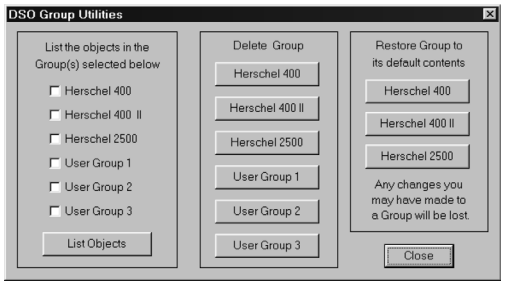
field is 4 degrees or smaller (instead of 5 degrees). Click the **Set Thresholds** button in the DSO Database Options dialog box. Then enter the desired field sizes for the various threshold values.

6.1.3 DSO Groups

Another DSO filter option is to limit the display to one or more **Groups**. MegaStar supplies three predefined Groups: Herschel 400, Herschel 400 II and Herschel 2500. These are observing programs from the Astronomical League. When the **Show Group(s) Only** option is selected in the DSO Database Options dialog box, you can choose which Group(s) to display. Only those objects which are contained in those Groups will be plotted.

There are also three user-definable Groups, for which you can select your own objects. The DSO Properties dialog box described in the previous section will let you change the Group membership of an object.

The DSO Database Options dialog box has a **Groups button**, which provides some utility functions for manipulating Groups. The **List Objects** button will display a listing of the contents of selected Groups. You can delete the contents of a Group, or restore the Herschel Groups to their original default contents.



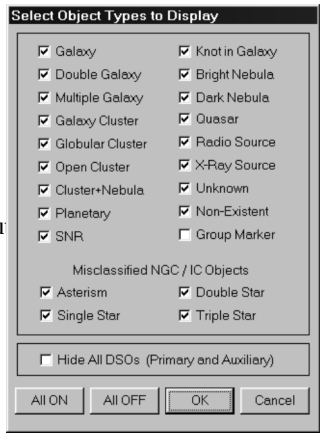
6.2 Filter by Type

Select the types of deep sky objects that you want to display.

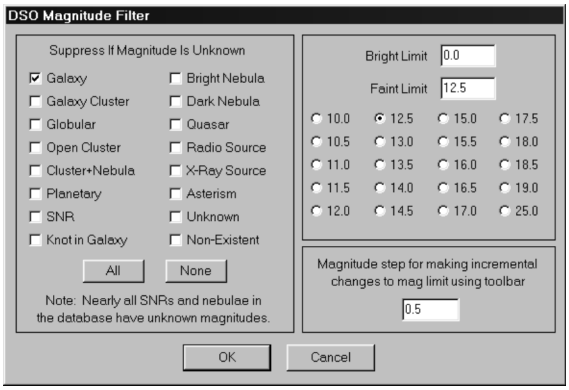
"Group Marker" is not an actual object type. This is a circle used to indicate an object grouping, such as a Hickson galaxy group.

This dialog box also provides a "master switch" to control the display of DSOs. Clicking "Hide All DSOs" will suppress the display of DSOs, without altering any of the individual type-filtering selections.

Note that the Single, Double and Triple Star types refer to NGC and IC objects which were at one time misclassified as galaxies, nebulae, etc. Turning Double Stars off in this dialog box will not affect the display of true double stars from the *Washington Catalog*.



6.3 Magnitude Filter

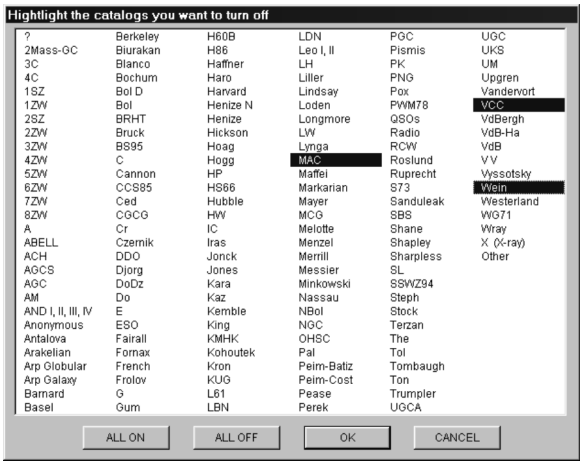


Use this function to filter DSOs by magnitude. The faint limit can be selected by clicking on one of the preset values provided, or by typing the value into the text box. The bright limit must be typed in.

You can also choose to suppress the display of objects that have an unknown magnitude.

There are hot key and toolbar commands for adjusting the DSO faint magnitude limit. This dialog box provides a setting for the increment that these commands will use when increasing or decreasing the magnitude limit.

6.4 Catalog Filter



This function filters DSO objects by catalog designation.

Highlight the catalogs which you want MegaStar to ***ignore*** for display. To choose the specific catalog designations which you want to activate, click the "All Off" button, and then "unhighlight" the desired entries. Those which are ***not*** highlighted will be displayable. To ignore specific catalogs, click the "All On" button and then select those entries which you do not want to see displayed.

For example, if you want to display only objects which have a Markarian designation, you would click the "All Off" button, and then click "Markarian" to make it the only active catalog.

Note: If *any* of any of an object's alternate catalog designations are activated, then that object will still be displayed. For example, if you have turned "Arp" off and "NGC" on, and an object has both an NGC and an Arp number, then that object will

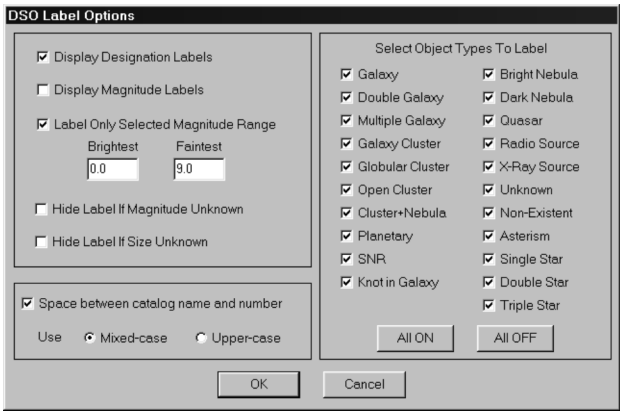
still be displayed.

Note that this function treats the MAC catalog as a special case. The MAC is a large database of very faint galaxies, and many users will not want to display this data. As described in Section 2.3.7 on page 13, this catalog can be activated from the Database Options dialog box. If the MAC catalog has not been previously loaded, the "All On" button will not automatically activate it. However, you can manually click on the MAC entry to activate it.

The first entry in the catalog list is "?," and refers to objects which do not have a common catalog designation. For example, there are several disconnected wisps of nebulosity in the Veil Nebula complex which are only designated with a "?" in MegaStar.

The last entry in the list is "Other." This refers to objects which have a name, but are not included in any common catalog. It also refers to very small catalogs which contain only a couple of objects. Rather than give these a separate entry in the list, they are included under "Other." Some examples are: LMC, SMC, Pyxis Cluster, Eridanus Cluster and Hyades. Refer to Appendix B on page 125 for a complete list.

6.5 Label Options



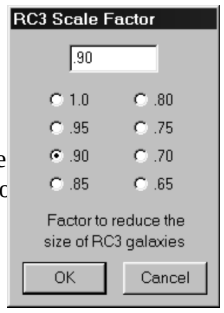
DSOs can be labeled with their designation and/or magnitude. If both are turned on, the magnitude will be appended to the designation. Magnitudes are to the nearest tenth, with the decimal point omitted (142 = 14.2). Crowded fields can make labels difficult to read, as they tend to overlap each other. This can be alleviated somewhat with the use of the label filters provided.

Two options are provided to modify the format of the labels. You can choose whether or not to put a space between the catalog name and the number, and you can choose mixed- or upper-case. The object "Minkowski 1-71" can therefore be labeled "MINK1-71", "Mink1-71", "MINK 1-71", or "Mink 1-71". If you are using a very small font for printing, upper-case text may make the labels more readable.

6.6 Select Symbols

This is identical to the "Symbols & Lines" function in the "Options" menu. It has been duplicated in the DSOs menu for convenience. Refer to 11.2 on page 100 for a description of this function.

6.7 RC3 Scaling



The values for the sizes of galaxies in the *Third Reference Catalog of Bright Galaxies (RC3)* are referenced to a surface brightness of 25.0 B-mag per square arcsecond. In many cases, the resulting dimensions are quite a bit larger than what can be imaged by amateur equipment, even CCDs. It is certainly beyond what can normally be observed visually. If you are using charts or the screen display to correlate against photographs or CCD images, you can use this option to help reduce the disparity in some of the galaxy sizes.

If a factor of 0.8 is selected, RC3 galaxy dimensions will be multiplied by 0.8. *Only galaxies from the RC3 catalog will be affected by this function*.

This will only affect the size of the symbol displayed on the screen or printed chart. The data box and other data listings will still report the original RC3 size.

6.8 Screen Listing

This will display a tabular list of all the deep sky objects appearing in the currently displayed field. The list is presented in a scrollable window. This window contains a number of buttons for performing various operations on the list. Refer to Section 10.5 on page 95 for a description of the Data Listing Window and the options available.

This function provides a convenient means of generating object lists to accompany finder charts. But unless you use the “Preserve Aspect” option when printing charts, the list may not contain all of the objects on the chart. Without the “Preserve Aspect” option, the field size of the printed chart may be somewhat larger than the field on the screen.

6.9 DSO Database Utility

This provides functions for listing, creating and modifying DSO data. A new window will appear, having its own set of menus. You can keep the DSO Utility window throughout your MegaStar session, treating it as if it were a separate application. It can be resized or minimized.

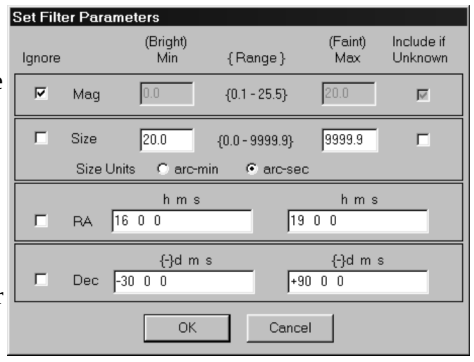
6.9.1 Generating Object Lists

You can view lists of objects from either the Primary or Auxiliary databases. The Primary database will include the MAC objects if they have been activated for display.

Note: There is a limit of 5,000 objects that can be listed by the DSO Database Utility.

Before you generate a list, you should first set the desired filtering parameters. Probably the best way to explain the operation of this feature is by showing an example. Suppose you wanted to make a list of all Minkowski planetary nebulae in MegaStar's database that are 20 arc-sec in diameter or larger, between 16h and 19h RA, and north of −30° Declination. You would proceed as follows:

Choose the **Filters | Limits** menu to display the dialog box for entering various filtering parameters.



You would enter "20.0" for the minimum size (as shown), making sure that the "arc-sec" button is selected for the size units.

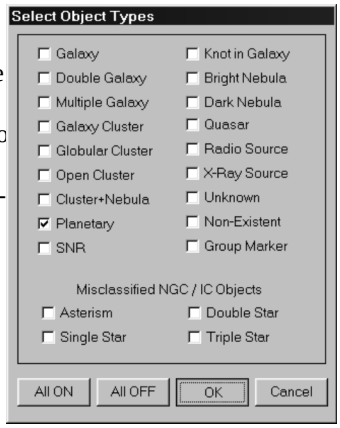
Since we are not interested in filtering by magnitude, the "Ignore" box has been checked for that parameter. The Ignore option can be useful for temporarily disabling a search criterion without having to alter the corresponding settings, which you may want to keep.

Notice also the "Include if Unknown" options for magnitude and size. You may want to filter a search by magnitude, yet include in the list those objects that have an unlisted magnitude.

Finally, the appropriate values are entered for the RA and Dec range of interest. You should always limit the RA to only the range in which you are interested. This will reduce the amount of data which must be read, and will speed up the listing process.

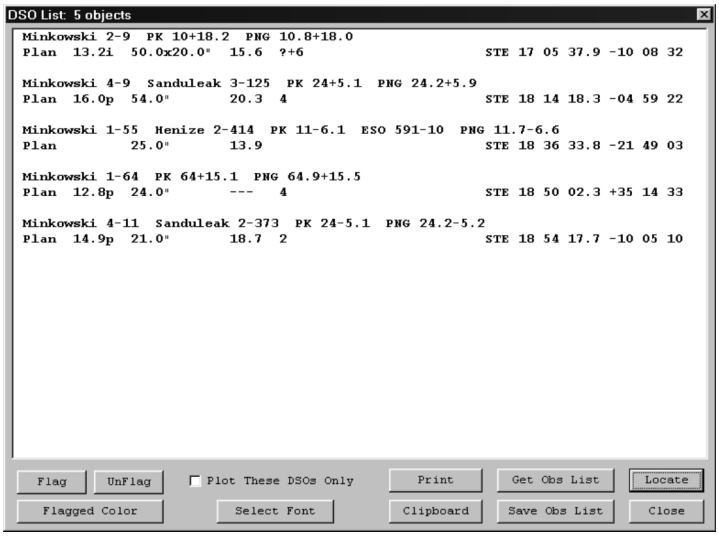
The next step is to limit the search to planetary nebulae. If you choose **Filters | Types** from the menu, a dialog box is displayed for selecting the object types of interest. In this case, only "Planetary" has been selected.

Finally, choose **Filters | Catalogs** to display a dialog box containing a list of all the catalog designations in the database. If you want to limit the search to just a few catalogs, choose the "All Off" button, and then select those entries you want to include (in this case, Minkowski).



A fourth filter option is provided: Constellation. In this example, we are not interested in filtering the list by constellation.

All of the filter parameters have now been set, and the list can be generated. Choose **Primary DB,** and select **List Objects.** The following output window will be displayed:



There are a number of things that you can do with this list. For example, you can locate any entry by double-clicking on that line (or highlight the line and click the "Locate" button). For a complete description of all the options available in the Data Listing Window, refer to Section 10.5 on page 95.

To list objects in an Auxiliary database, you would choose **Auxiliary DB | Filtered List**. The **Auxiliary DB | List All Objects** function will not perform any filtering, regardless of any filter settings you have made.

6.9.2 Modifying Data

Both the Primary DB and Auxiliary DB menus have a Modify Object function. This will display a dialog box which asks you to enter the designation of the object you wish to modify. You must enter a catalog designation, not a common name. If the object is found in the database, the data modification dialog box will be displayed.

For the Primary data, you cannot modify or add designations, and you cannot change the coordinates. The text entry boxes for those items will be disabled. All other data fields can be modified.

You cannot modify or add quasars in this release.

Note that any data items which are not applicable to the object type will be disabled.

Here are some guidelines for entering data:

Major/Minor Axis—The valid range is 0.1 to 9999.9. Blank out the field to denote an unknown size. If the Minor Axis is blank, the object is considered to be circular. Be sure that the units (arc-min or arc-sec) are selected properly.

Magnitude—The valid range is 0.1 to 25.0. Blank out the field to set the magni-

tude to "unknown." Be sure to select the appropriate value for the type of magnitude you are entering: (V)isual, (B)lue, (P)hotographic, or (?) if the magnitude system is not known.

Desc/Class—This field is free-format: you can enter any text you wish, up to 15 characters.

Pos. Angle—The valid range is 0 to 179. Blank out the field to denote an unknown value. P.A. is measured in degrees, from north to east.

Cen. Star Mag—(Magnitude of Central Star)—The valid range is 0.1 to 25.0. Blank out the field to indicate an unknown magnitude.

 # Stars—(Number of Stars)—The valid range is 1 to 16383. Blank out the field to set the value to "unknown".

 # Galaxies—(Number of Galaxies)—The valid range is 1 to 16383. Blank out the field to set the value to "unknown".

S.B.—(Surface Brightness)—The valid range is 0.1 to 25.0. Blank out the field to indicate an unknown value.

6.9.3 Adding Objects

You can add your own DSOs to MegaStar using the Auxiliary Database. If you are creating a new Auxiliary file, choose **Auxiliary DB | Create New File** and enter a file name in the dialog box. If you want to add objects to an existing file, choose **Auxiliary DB | Select Existing File**. You only need to select a file once. All subsequent add operations will append objects to that file.

After you have selected the file, choose **Auxiliary DB | Add Object**. A data entry dialog box will be displayed. This is the same as the dialog used for modifying objects, except that the fields will initially be blank (except for the coordinates and object type). The coordinates are initialized to the current coordinates in MegaStar's Readout Bar. So if you click the spot on the field where you want to add an object, the coordinates will be automatically set to that location.

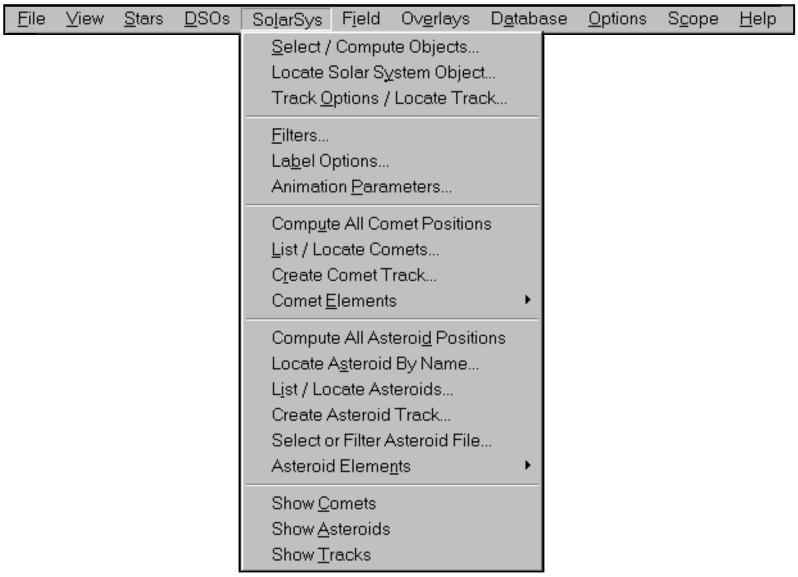
You can create as many different Auxiliary DSO files as you want. However, only one file can be activated for display at any given time. Note that when you create a new Auxiliary file using the **Create New File** function, that file will then become the active file for display.

Once you have created one or more Auxiliary files, you can use the **List Objects, Modify Object** and **Delete Object** functions. When listing Auxiliary DSOs, any filters that may have been set in the "Catalogs" menu will be ignored. The **Delete** and **Modify** functions will prompt you to enter the name of the object. As with the "Locate" function, the text you enter is not case-sensitive, and blank spaces are ignored.

6.10 DSO Toolbar

a. Show/Hide Primary DSOs, including MAC, if activated (6.1).
b. Show/Hide Auxiliary data (6.1).
c. Show a listing of all DSOs in the current field (6.8).
d. Show Observing List DSOs only (6.1).
e. Show single target DSO only (6.1).
f. Display DSO Database Options dialog box (6.1).
g. Show/hide DSO designation labels (6.5).
h. Show/hide DSO magnitude labels (6.5).
i. Increase DSO magnitude filter limit (6.3).
j. Decrease DSO magnitude filter limit (6.3).
k. Set magnitude filter to auto mode (6.3).

Chapter 7. SolarSys



7.1 General Comments

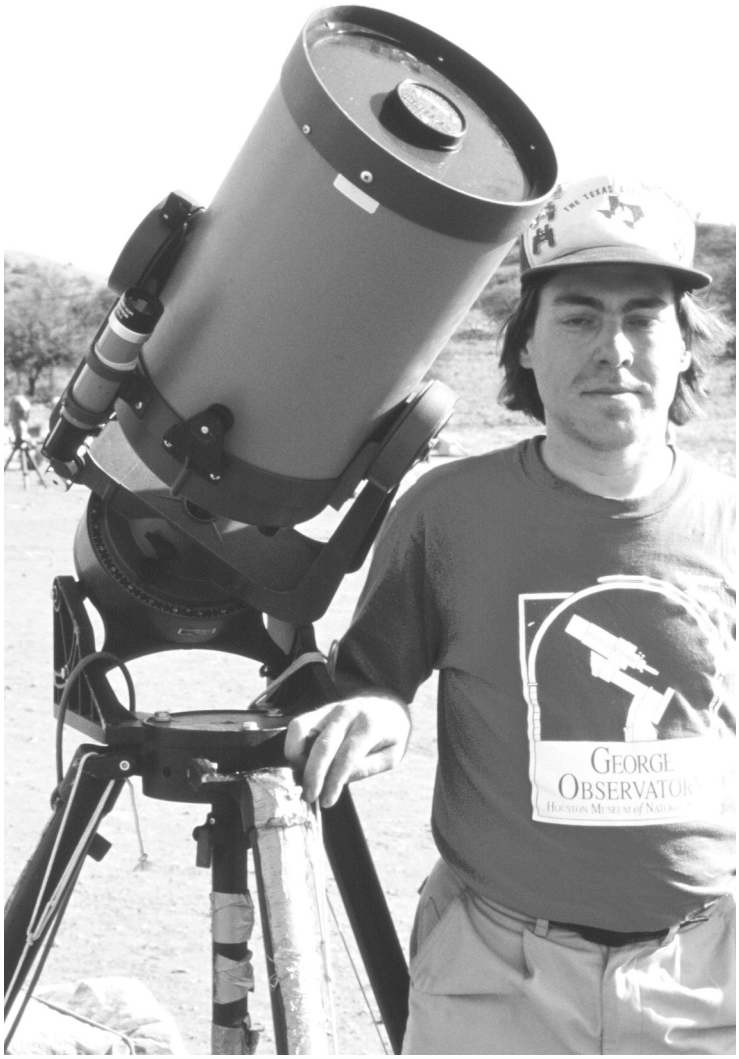
Before plotting solar system objects, enter the **latitude** and **longitude** of your observing site (using "Options | Location" in MegaStar's main menu). A **reference time** should also be set ("Options | Set Date/Time"). This reference time can be either the system clock of the PC, or a fixed time that you specify. This is the time which is displayed in the caption bar of the MegaStar window.

Each time MegaStar is launched, the planet and comet positions will be re-computed using the reference time. If a static reference time has been selected, then the positions will not change from the previous session. If the PC system clock is used, the positions will be automatically computed for the current PC time.

There are two ways that MegaStar can plot solar system objects: As **single points** at a specified reference time, or as **tracks**. Tracks consist of multiple points having a selectable starting time and time interval. Note that the time reference for tracks is completely independent of the "reference time" used for single points.

MegaStar is capable of producing fairly accurate plots of comets and asteroids. These positions are topocentric, and are corrected for both light time and parallax. While the accuracy of asteroid positions will usually be sufficient to locate the object, it is not adequate for any kind of astrometry or other position-critical applications, such as occultation predictions.

Also, the accuracy obtained for comets and asteroids will only be as good as the orbital elements that are used. No perturbation factors are applied in the computa-



Matthew Delevoryas has had a long-term interest in celestial mechanics and planetary motion. He provided significant assistance in this area for this release of MegaStar and plans to assist with many new features in the future. These will be included with intermediate upgrades that will made available over the web at www.willbell.com to registered users. Matthew is shown here with his pride and joy, one of the most optically perfect Celestron 8 ever made which with his keen eyeseight has allowed him to see many of the Mitchell Annonomous Galaxies.

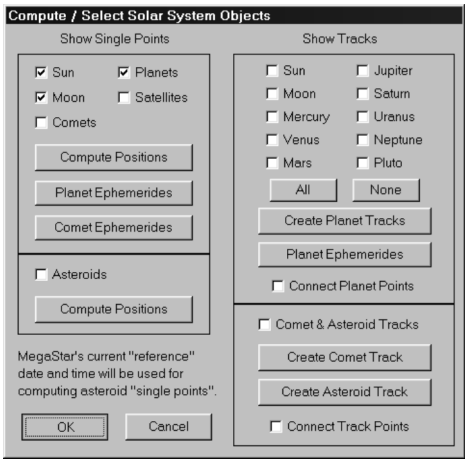
tions, so you should use osculating elements that are as close to the epoch of plotting as possible. Elements will only be accurate for a limited time (sometimes only for weeks in the case of comets). Links for downloading new comet and asteroid elements can be found on the Willman-Bell, Inc., web site (http://www.willbell.com). MegaStar supports two sources of asteroid orbital elements: Lowell Observatory and the Minor Planet Center (MPC). Both of these sources provide element data in a format which is directly compatible with MegaStar.

The sun, moon and planet positions are not rigorously computed, and the accuracy should not be relied upon to be better than about 15 or 20 arcsec.

Note also that the parallactic angle of the moon is not represented in MegaStar. The moon is always plotted with the axis in a north-south orientation.

You can left-click on solar system objects to display a data box containing information about the object. The altitude, azimuth, and rise/set/transit times that appear in these data boxes are referenced to the date and time for which the object was plotted.

7.2 Select / Compute Objects



This dialog box performs the following functions:

- Select objects to display.
- Compute positions.
- Create tracks.
- View ephemerides.
- Set reference time.
- Select asteroid file.

The left half of the dialog box is devoted to single-point operations, and the right half to track operations.

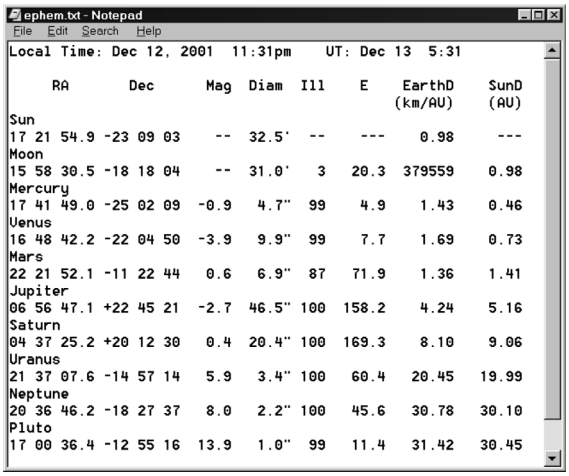
Several of the functions included in this dialog box are identical to functions in the **SolarSys** menu, and are duplicated here for your convenience. To avoid repeating the same description twice, you will be referred to the appropriate section for those functions.

7.2.1 Single-point functions

Check boxes are provided for selecting which objects you want to display.

The **Compute Positions** button in the top section of the dialog box will compute all sun, moon planet and comet positions, using the current setting of the reference date and time.

The **Planet Ephemerides** button will display a Notepad window containing planetary data. Using the built-in functions of Notepad, you can then save this information to a file, copy it to the clipboard, or print it.



The **Comet Ephemerides** button will produce a similar window for comets.

The **Compute Positions** button in the asteroid section will compute the positions of all active asteroids for the current reference date and time.

The **Select Asteroid File** button will display a dialog box for selecting the asteroid file and the number of active asteroids. This is identical to the "Select or Filter Asteroid File" menu function, which is described in Section 7.17 on page 72.

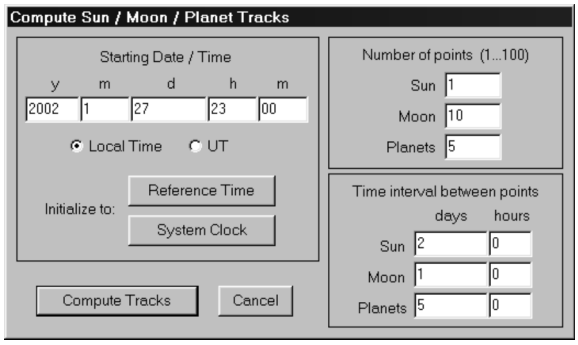
The **Set Date/Time** button displays a dialog box for selecting the date and time used in the "Compute Position" computations. This is identical to the "Set Date/Time" function in MegaStar's Options menu, which is described in Section 11.8 on page 102.

7.2.2 Track functions

Check boxes are provided for selecting which tracks you want to display. "All" and "None" buttons are provided for quickly clearing or setting the planet selections. There are also check boxes for choosing whether to draw connecting lines between planet or comet/asteroid track points.

The **Create Planet Tracks** button displays a dialog box for entering the track parameters:

- Starting data/time
- Number of tracks.
- Time interval between points



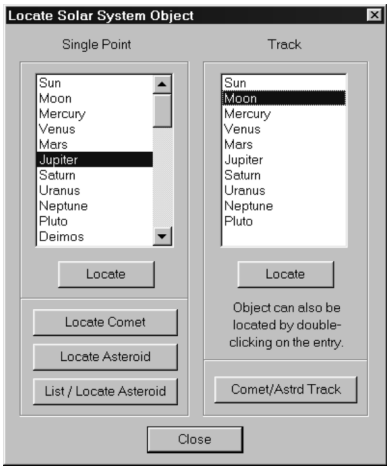
Note that the number of points and time interval are set independently for

the sun, moon and planets. Note also that the number of points can be set to "1." This provides a way to plot a single point for a time other than the reference time used in the normal single-point computations.

After you have entered your parameters, click the **Compute Tracks** button.

The **Create Comet Track** and **Create Asteroid Track** buttons display dialog boxes for entering the track parameters. These are identical to the functions that are available in the main SolarSys menu. Refer to Section 7.10 on page 69 and Section 7.16 on page 72 for details on creating comet and asteroid tracks.

7.3 Locate Solar System Object

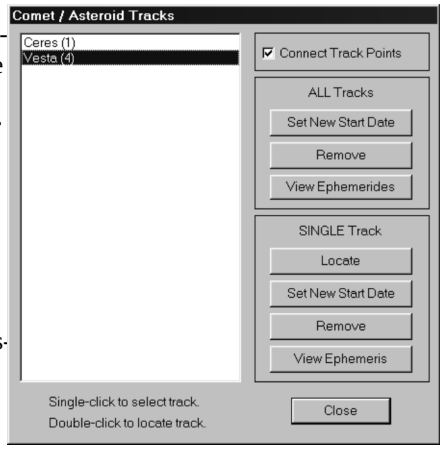


This dialog box lets you locate a solar system object, either as a single point or a track. For the sun, moon and planets, double-click on the single point or track entry you wish to locate, or highlight it and click the **Locate** button.

The **List/Locate Comet**, **Locate Asteroid** and **List/Locate Asteroid** buttons will display dialog boxes for locating comets and asteroids. These are identical to the corresponding menu functions described in Section 7.9 on page 69, Section 7.14 on page 71 and Section 7.15 on page 71, respectively.

The **Comet/Astrd Track** button is identical to the "Track Options/Locate Track" menu function, described in the next section.

7.4 Track Options / Locate Track



This dialog box performs various operations on comet and asteroid tracks. The buttons on the right side of the dialog box are divided into two groups. The upper group performs operations on *all* the tracks. The lower group operates on a *single selected* track (the one that is currently highlighted in the list).

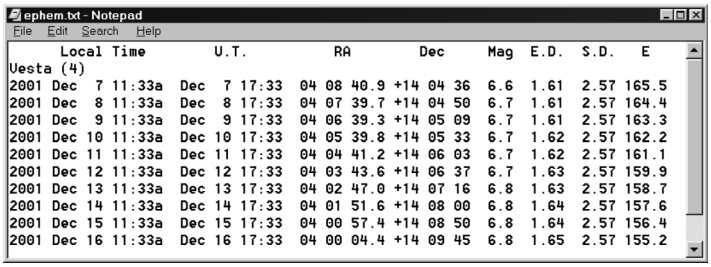
To locate a track, double-click the desired entry.

A check box is provided for choosing whether to draw connecting lines between track points.

The **Set New Start Date** buttons allow you to modify the starting date and time of the track(s). All positions will be recalculated using the new starting time that you enter in the dialog box that appears. The number of track points and time interval will not be changed.

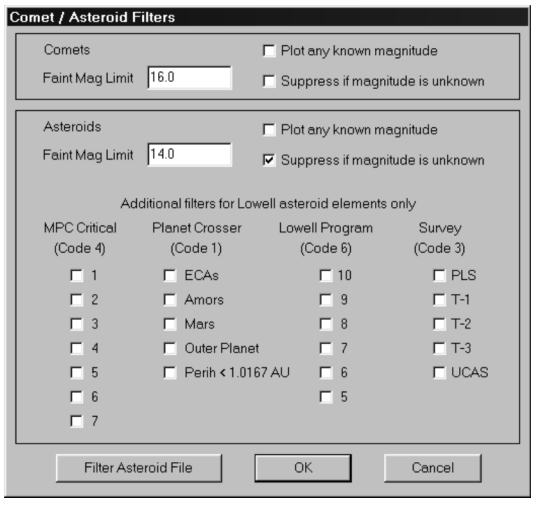
The **Remove** buttons will delete tracks.

The **View Ephemerides** buttons will display a Notepad window containing information about the track points:



- Local and Universal Time (U.T.)
- RA and Dec
- Magnitude
- Earth Distance (E.D.)
- Sun Distance (S.D.)
- Elongation from the Sun (E)

7.5 Filters



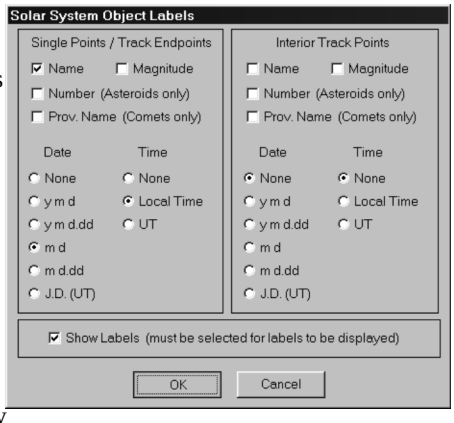
Faint limit magnitude filters can be set for comets and asteroids. There are also options to suppress the display of objects having unknown magnitudes and to display all objects which have any known magnitude. The latter option will override any faint limit which was entered in the text box.

There are some additional filtering options for asteroids: MPC Critical, Planet Crossers, Lowell Observing Program, and Survey. **These filters are only valid if you are using the Lowell asteroid data** (as opposed to the MPC data). Refer to the file “astrddoc.txt” in the \docs directory of the CD-ROM

for an explanation of the codes used in this dialog box. Note that if multiple filters are selected, an asteroid only needs to match one of the filters (along with the magnitude filter) in order to be displayed.

The **Filter Asteroid File** button will display a dialog box for creating a subset of the main asteroid data file, based on various filtering criteria. This is identical to the **Create Filtered Subset** button in the "Select or Filter Asteroid File" menu function. Refer to Section 7.17 on page 72 for a description of this function.

7.6 Label Options



Solar system object labels can consist of any combination of name, date, time and magnitude. Click the check boxes to select the desired components for the label.

The section on the left side of the dialog box will apply to single point and track endpoint labels.

The section on the right side of the dialog box applies only to interior points of tracks. It may be useful to choose different labeling options for interior points than for endpoints. For example, if a track is plotted at 1-day intervals, you may want to label the name, date and time only at the endpoints. But for the interior points, label only the month and day (since the time will be the same for every point).

When setting the labeling options, make sure that the **Show Labels** box is checked. If it is not, then no labels will appear, regardless of which components are turned on. This "master switch" for displaying labels is useful if you want to quickly turn the labels off temporarily, without affecting your normal label configuration. If you have assigned a hot key to this function, then you can quickly toggle the labels on and off.

7.7 Animation Parameters

Animation enables you to view the apparent motion of solar system objects. You can also view the apparent motion of the sky itself. This dialog box is only for setting certain options, such as the starting date/time and the time interval between animation steps. The actual activation and control of animations can only be performed using the Animation Toolbar or by using hot keys. There are no menu items for animation control. To show the Animation Toolbar, go to the "View | Select Toolbars" menu and put a checkmark in the "Animation" option. Then make sure that the "View | Show Toolbars" menu option is checked.

7.7.1 Animation Toolbar

a. Run Backward. Runs the animation backward in time. The animation will continue until you stop it with the "stop" button.
b. Step Backward. Steps the animation one time interval backward.
c. Stop Animation.
d. Step Forward. Steps the animation one time interval forward.
e. Run Forward. Runs the animation forward in time. The animation will continue until you stop it with the "stop" button.
f. Reset Time. This only applies to the "Run Forward" and "Run Backward" operations. The time will be reset to the time at the start of the animation. Any displayed trails will be removed, and objects will be restored to their original positions
g. Show/Select Time Step Interval. Clicking this button will display a dialog box for entering the time interval.
h. Increase Step. Increases the time step interval. There is a predefined list of time steps, and this will go to the next higher step. The sequence is: 1 min, 2 min, 5 min, 10 min, 30 min, 1 hr, 2 hr, 6 hr, 12 hr, 1 day, 2 days, 5 days, 10 days, 15 days, 30 days, 60 days, 100 days and 180 days.
i. Decrease Step. Decreases the time step interval, using the same sequence as described above.
j. Animation Parameters. Displays the Animation Parameters dialog box. You can select the animation mode, time step interval, and the starting date/time.
k. Show/Hide Trails. Toggles the "Show Trails" option on or off. If Show Trails is turned on, then all plotted positions will be retained throughout the animation. Otherwise, only the most current position of the object will be displayed (the previous position will be erased each time the step is advanced).
l. Animation Mode. This will toggle between animating solar system objects and animating the sky.
m. Lock On Object. This only applies if the animation mode is set to "Solar System." Normally, objects will move across the field during an animation. But if you "Lock" on an object, then that object will remain at a fixed position at the center of the field, and the sky will move behind it. To lock on an object, click the "Lock On Object" button (the "lock" icon will change to a locked position). Then click on the desired object so that its data box is displayed. The locking action will only occur if the data box appears.

Note that "Show Trails" and "Lock On Object" are mutually exclusive options. Both options cannot be selected at the same. Also, these two options are only applicable when the animation mode is set to "Solar System."

Here is the appearance of the Animation Toolbar for various option settings:

With animation mode set to “Solar System” and “Lock on Object” selected:

With animation mode set to “Solar System” and “Show Trails” selected:

With animation mode set to “Sky” (Trails and Lock options do not apply):

7.8 Compute All Comet Positions

This function computes the current position of every comet in the database, using the reference time selected in “Options | Set Date/Time.” The field will automatically refresh after the new positions have been computed.

Note that if the system clock has been selected as the reference time, the positions will not be updated automatically in real time. They will remain static at the time they were computed. You must therefore execute this command whenever you want to update the positions.

7.9 List / Locate Comets

A scrollable list of all comets in the database will be displayed. To locate a comet, double-click on the entry, or highlight it and click the **Locate** button.

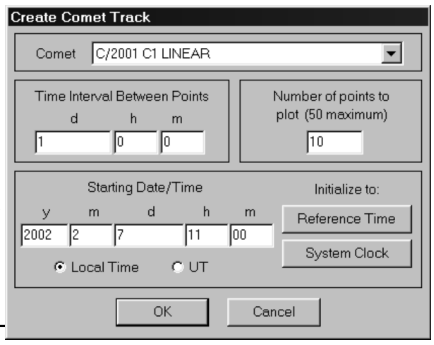
Only those comets which are activated will be displayed. An asterisk (“*”) in front of the comet name indicates that it is active. To activate or de-activate a comet, highlight the entry and click the **Activate** or **De-Activate** button. To change the activation state of all comets in the list at once, use the **All On** and **All Off** buttons.

Note that when you execute the “Compute All Comet Positions” command, it will compute the positions of every comet in the database, whether it is activated for display or not.

7.10 Create Comet Track

This dialog box lets you set the parameters for a comet track. When you click the **Compute Track** button, the display will refresh and center on the first point of the comet’s track. Note that you can only specify tracks for up to 20 objects (comets and asteroids combined).

Comet—Click on this box to display a list of comets in the database and select the comet to be plotted.



Time Interval Between Points—Enter the time interval (in days, hours, and minutes) between the points to plot. A decimal point is allowable in the "day" field. **Number of points to plot—**Enter a number from 1 to 50 for the number of points. **Starting Date/Time—**Enter the date and time for the first point of the track. Options are provided for indicating whether the time is specified in Local Time or Universal Time (UT). The **System Clock** button will fill in the date and time using the PC's system clock. The **Reference Time** button will fill in the date and time with the time reference that was selected in the "Options | Set Date/Time" function.

You can locate or remove tracks using the "Track Options / Locate Track" menu function described in Section 7.4 on page 65.

7.11 Comet Elements | Add New

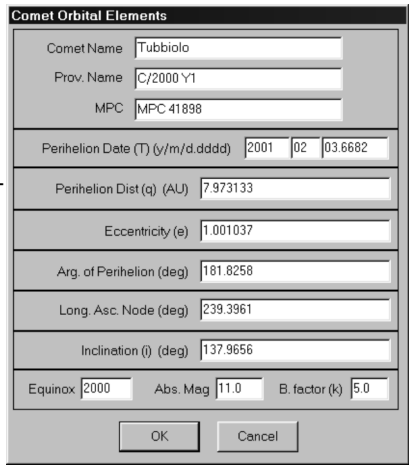
If you have access to orbital element data, you can add comets to the database using this function.

The Comet Name or Prov. Name (Provisional Name) may be blank, but not both. The MPC number is optional.

The values "Abs. Mag" (absolute magnitude) and "B. Factor" (brightness factor, or k) are used for magnitude estimation. The following formula is used for computing the magnitude:

mag = G + 5 log(delta) + k log(r)

where: G = absolute magnitude
k = brightness factor
Delta = earth distance
r = sun distance



The comet element data is stored in an ASCII text file named "comet.txt," located in the MegaStar working directory. Therefore you can add or modify entries using a text editor, if you wish. However, the placement of the data must strictly conform to the format described in the file "cometdoc.txt" in the \docs directory of the CD-ROM. Adding or modifying elements using this utility is safer, and is the preferred method. Even so, it would be a good idea to always make a backup copy of "comet.txt" before making any changes.

7.12 Comet Elements | Modify / Delete

This is similar to adding elements, except you will select an existing comet from the database. The element dialog box will be initialized with the current elements of that comet.

If you delete an element, it will be physically removed from the comet database file, and you will not be able to recover it later.

Be sure to back up the "comet.txt" file before modifying or deleting elements.

7.13 Compute All Asteroid Positions

This function computes the current position of every active asteroid in the database, using the reference time selected in "Options | Set Date/Time." The field will then be automatically refreshed.

Note that if the system clock has been selected as the reference time, the positions will not be updated automatically in real time. They will remain static at the time they were computed. Also, unlike planets and comets, asteroid positions will not be automatically recomputed at the beginning of each new MegaStar session. You must therefore execute this command whenever you want to update the positions.

This operation can take considerable time, depending on the number of active asteroids and the speed of the PC. You can specify the number of active asteroids using the "Select or Filter Asteroid" function described in Section 7.17 on page 72.

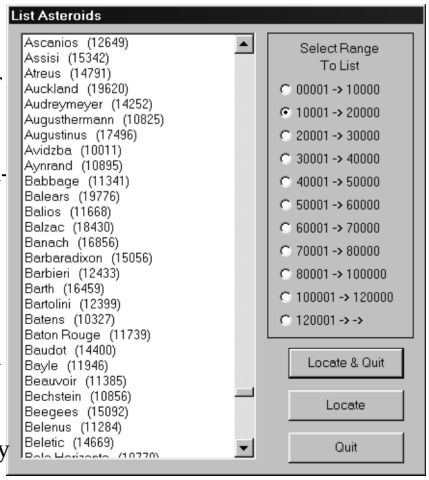
7.14 Locate Asteroid By Name

If you know the name or number of an asteroid you want to locate, use this function. If you enter a name, the text will not be case sensitive.

If you are unsure of the spelling or number, you can display a list of asteroids using the "List / Locate Asteroids" function.

7.15 List/Locate Asteroid

This displays a scrollable, alphabetized list of asteroids in the database. But because the number of asteroids can far exceed the number of lines that Windows can put in a list box, the asteroid database is divided into sections. The range numbers that are listed correspond to the asteroids' positions in the data file, and not the asteroid numbers assigned by the MPC.



To display a list, select the range of asteroids to view. It may take a few seconds for the list to be loaded. You can select a new range to display any time.

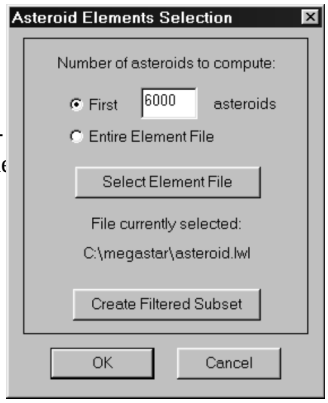
To locate an asteroid, double-click on the entry. Or you can highlight an entry

and click one of the “Locate” buttons. The **Locate & Quit** button will refresh the field and remove the dialog box. The **Locate** button will refresh the field, but the dialog box will remain. This will allow you to locate a different asteroid without needing to redisplay the dialog box.

7.16 Create Asteroid Track

This is nearly identical to the “Create Comet Track” dialog box described in Section 7.10 on page 69. The only difference is that you must type the name or number of the desired asteroid. If you enter a name, the text will not be case sensitive.

7.17 Select or Filter Asteroid File



You can have multiple files of asteroid elements, but only one file can be active at any given time. The name of the currently active file appears in the dialog box beneath “File Currently Selected.”

MegaStar supports two types of asteroid element data: The **Lowell Observatory** data and the **Minor Planet Center** (MPC) data. The former must have a file extension of “.lwl,” and the latter must be “.mpc.” These extensions can be either uppercase or lowercase. The file *names* can be anything you choose.

To download new elements from Lowell, go to ftp.lowell.edu/pub/elgb/ and download the file “astorb.dat” or “astorb.dat.gz.” The latter is a compressed version, which must be decompressed using gzip.exe. Refer to the file “astrddoc.txt” in the \docs directory of the MegaStar CD-ROM for instructions on decompressing the file. After you have downloaded the file (and decompressed it, if necessary) you must rename it to have a file extension of “.lwl” before MegaStar can access it.

To download new elements from the Minor Planet Center, go to their web site at http://cfa-www.harvard.edu/iau/Ephemerides/SoftwareEls.html and click on the MegaStar link. After downloading an asteroid file, you must rename it to have a file extension of “.mpc” before MegaStar can access it.

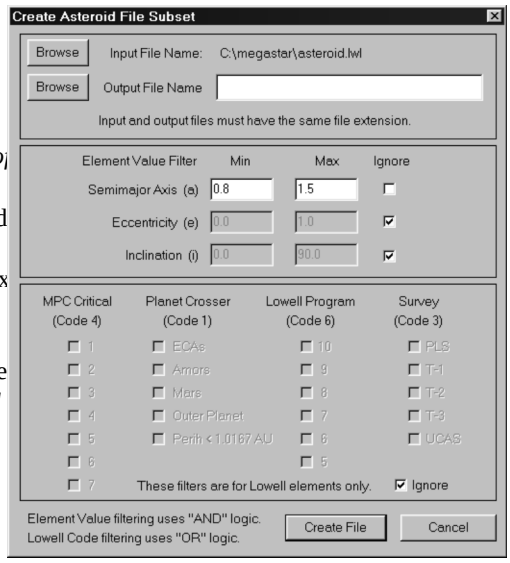
To select an asteroid data file that you want to activate, click the **Select Element File** button. The Windows “Select File” dialog box will only display files which have one of the valid file extensions (“lwl” or “mpc”).

You can also select the number of **active asteroids**. If, for example, you have downloaded the full Lowell database, it will contain at least 160,000 asteroids (as of this writing). You may only be interested in displaying the brighter asteroids, which will tend to be toward the beginning of the file. So if you want to display only the first 6,000 asteroids in the file, type that number into the text box under **Number of asteroids to compute**. To activate the entire file, select the **Entire Element File** option.

Keep in mind that the time required to complete the “Compute All Asteroid Positions” command will depend directly on the number of asteroids that have been activated, and it can be quite lengthy for the full Lowell database.

7.17.1 Creating a filtered subset file

The **Create Filtered Subset** button in the dialog box described in the previous section lets you create a new element file from an existing one, with various filtering options applied.



Select the names of the original element file (input file), and the new file you wish to create (output file). *The file extension of the output file must match that of the input file*.

You can filter the data based on selected element parameters. Be sure to click the “Ignore” box for any parameter you do not wish to filter. These filter options use “AND” logic. In other words, the asteroid elements must satisfy ***all*** of the specified parameters in order to be included in the output file.

If you are filtering Lowell data, you can also set filters for various codes that Lowell uses in its data. Refer to the file “astrddoc.txt” in the \docs directory of the CD-ROM for an explanation of these codes. These filter options use “OR” logic. In other words, if an asteroid has any of the codes selected, it will be included in the output file.

Note: Do not confuse the Lowell code filtering options in this dialog box with those in the “SolarSys | Filter” dialog (Section 7.5 on page 66). Although they look identical, they are performing different functions. In this case, they will determine which asteroids will be included in the new element file you are creating. In the former case, they are filtering the display of asteroids for the currently active element file. These settings are completely independent of each other.

7.18 Asteroid Elements | Add New

If you have access to orbital element data, you can add asteroids to the database. Any asteroids you add will be placed at the end of the data file. Therefore, they will appear

in the last segment in the “List / Locate Asteroids” function.

If the set of orbital elements being added does not include the Semimajor Axis (*a*), but gives the Perihelion Distance (*q*), use the following formula to convert:

$a = q/(1 - e)$ where *e* is the eccentricity.

If only the Mean Motion (*n*) is given, use the following formula:

$a = ((0.9856076686 / n)^2)^{1/3}$

“H” and “G” are used for magnitude estimation. “H” is the absolute magnitude, and “G” is the “slope parameter.”

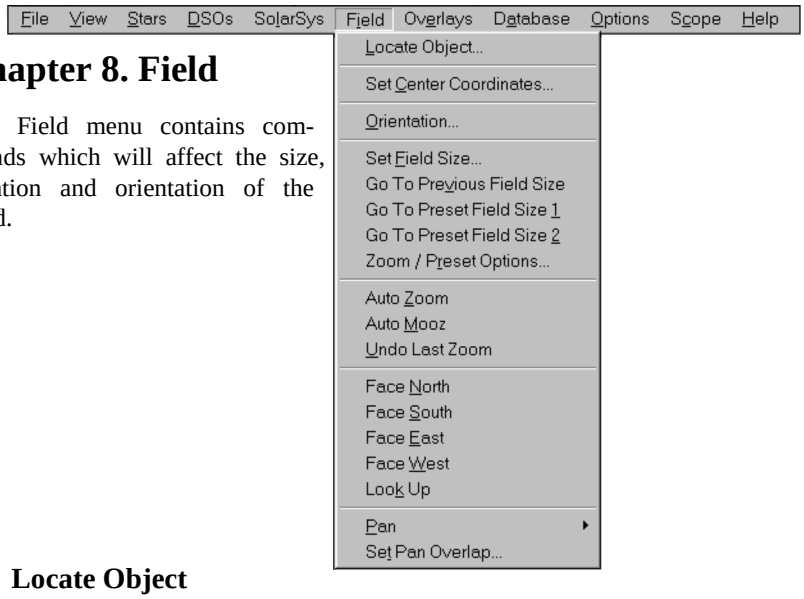
7.19 Asteroid Elements | Modify

This is similar to adding elements, except you are prompted to enter the name or number of the asteroid to modify. The dialog box is initialized with the orbital elements of that asteroid.

7.20 Show Comets/Show Asteroids/Show Tracks

These menu functions will toggle the display of single-point comets and asteroids, and the display of tracks. A checkmark will appear in the menu if that item is selected for display.

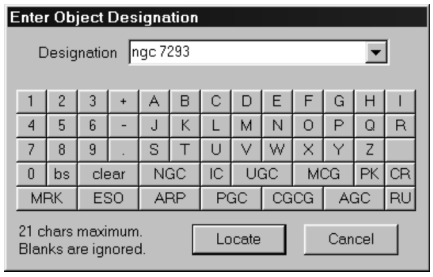
These functions can also be performed in the dialog box of the “SolarSys | Select/Compute Objects” menu, but are duplicated here for your convenience.



Chapter 8. Field

The Field menu contains commands which will affect the size, location and orientation of the field.

8.1 Locate Object



Enter the designation of the object you want to locate, and the field will be centered on that object.

The text you enter is not case sensitive. All blank spaces are ignored, so you can omit any embedded blanks.

For example, to find NGC 7293, you could enter any of the following:

NGC 7293
ngc7293
ngc 7293
n7293

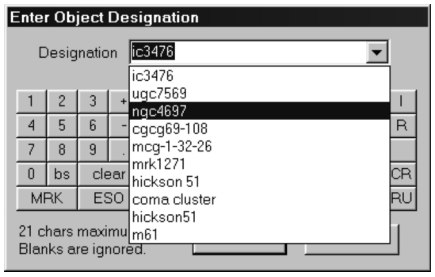
Section Appendix B on page 125 lists the catalog descriptions that are contained in the database. In some cases there is an abbreviation that can be used, such as “B” for “Barnard” and “N” for “NGC.” You must type the name or abbreviation exactly as it appears in that list (except for the case).

The Locate function can also be used to locate:

- Common names (DSOs and stars)
- Sun, Moon, and planets
- Constellations (using the 3-letter abbreviation in Section Appendix A on page 123)
- SAO stars (e.g., “SAO 1234”)
- HD stars (“HD 1234”)

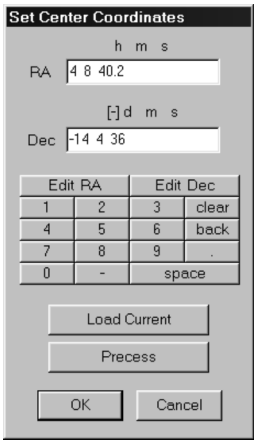
- GSC stars (“GSC 1234:1234” or “GSC 1234-1234”)
- Tycho stars (“TYC3105:2070:1”)
- Hipparcos stars (“HIP1234”)
- PPM stars (“PPM1234”)
- Flamsteed numbers (“61 cyg)”
- Bayer designation (“espilon lyr”)

Refer to Section 5.10 on page 43 for instructions on how to locate variable stars, and Section 5.14 on page 47 for locating double stars.



If you click on the down arrow at the right of the Designation text box, a list of the ten most recent names will be displayed. Highlighting one of these will place that name in the text box, providing a convenient means of relocating previous objects. Each time a new object is located, it will update the “recent list.”

8.2 Set Center Coordinates



Set the RA center by entering hours, minutes and seconds, separated by at least one blank space.

For the Dec, enter degrees, minutes and seconds, separated by at least one blank space. Indicate a southern Dec by preceding the degrees with a “–” or an “s”.

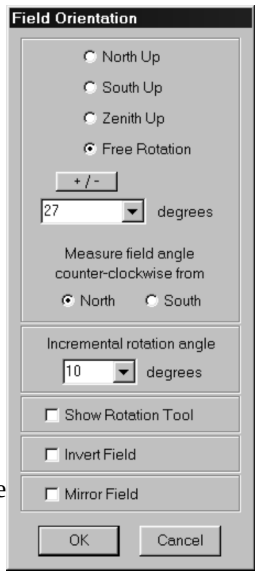
Decimal points are optional and allowed for all values. If minutes or seconds are omitted, they default to “0”.

Examples:
For a field center of RA = 12h 40m 20s and
Dec = −22° 35′ 30″, enter:
RA “12 40 48” or “12 40.8” or “12.68 0 0” or “12.68”
Dec “−22 35 30” or “−22 35.5” or “−12.59167”

For a field center of RA = 8h 24m 00s and
Dec = 17° 00′ 00″, enter:
RA “8 24 0” or “8 24” “8.4”
Dec “17 0 0” or “17 0” or “17”

Precess displays a dialog box to precess the coordinates you have entered to J2000.
Load Current will initialize the input boxes with the center coordinates of the currently displayed field.

8.3 Orientation



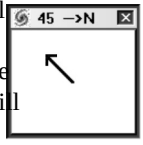
This dialog box provides a number of options for orienting the field.

North Up and **South Up** will make the central RA line vertical on the screen, which is the most common projection used for printed sky atlases.

Zenith Up will orient the field so that the horizon is horizontal, which depicts the sky as it appears to an observer standing on the ground and looking in the direction of the field center. **Note**: This mode cannot be used if you invoke the "Invert Field" or "Mirror Field" options. If "Zenith Up" is the current mode when the field is inverted or mirrored, MegaStar will automatically switch the mode to "Free Rotation."

Free Rotation allows you rotate the field to any desired angle (in whole degree increments). This can be useful when using MegaStar at the telescope, allowing you to orient the field to match the view in the eyepiece. The reference direction from which the angle is measured can be set to either North or South.

There is a "Rotate" button in the Field toolbar, and also an optional hot key to rotate the field. The **Incremental Rotation Angle** will determine how many degrees the field will rotate in response to these commands.

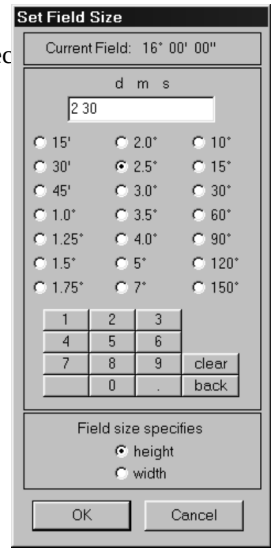


You can also display a **Rotation Tool** on the screen. This is a small window which can be used to rotate the field, providing a more convenient method than typing a rotation angle into the dialog box. The Rotation Tool can be dragged to any location on the screen. It will remain visible until you close it by clicking the "X" in the caption bar, or by unchecking **Show Rotation Tool** in the dialog box. To use this tool, place the mouse cursor in the window and press the left button. If you continue to hold the button down, you can drag the arrowhead to the desired angle. When the mouse button is released, the field will refresh to the new orientation. The angle and reference direction (either North or South) is displayed in the window's caption bar.

Invert Field will rotate the field 180°.

Mirror Field will reverse the field to match the view in a telescope having an odd number of mirrors, such as a refractor with a star diagonal.

8.4 Set Field Size



Set the field size by entering degrees, minutes and seconds, separated by at least one blank space. Or select one of the preset field sizes, which will place that value in the text box.

Since the field displayed on the screen is usually not square, the value that is specified can be either the vertical or horizontal extent, depending on which option has been selected at the bottom of the dialog box.

Entering minutes and seconds is optional, and decimal points are allowed for the degree or minutes values.

Examples:

For a 2° field, enter "2" or "2 0" or "2 0 0".
For a 2.5° field, enter "2.5" or "2 30" or "2 30 0".
For a 45 arcmin field, enter ". 75" or "0 45" or "0 45 0". (Don't forget the leading "0," or you will get 45°!)
For 1° 15′ 18″, enter "1.255" or "1 15.3" or "1 15 18". (Don't use the quotation marks (" ") in the text box.)

8.5 Go To Previous Field Size

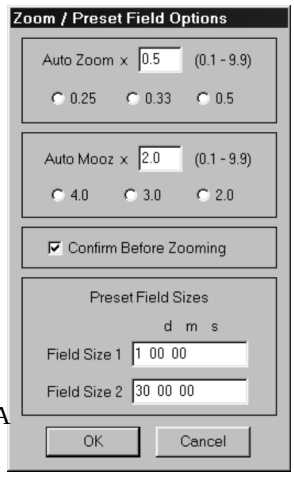
The previously selected field size will be restored. Repeatedly invoking this command will cause the field to toggle between the last two selected field sizes.

8.6 Go To Preset Field Size 1 and 2

These two commands will set the field size to a value that has been preset. Refer to the "Zoom/Preset Options" section below for instructions on setting these values.

If you frequently switch between a 15° wide-field view and a 1° close-up view, you can preset those two field sizes. This will provide a convenient way to quickly toggle between them, especially if you have assigned hot keys to these two commands (or are using the Field Size/Location toolbar).

8.7 Zoom / Preset Options



This dialog box allows you to select how much the field size will change in response to the Auto Zoom and Auto Mooz commands (described in the next section). The values you enter are multipliers. To determine the resulting field size, multiply the current field size by the zoom or mooz factor. For example, a zoom factor of 0.5 will cut the field size in half (giving a 2x zoom). A mooz factor of 2.0 will double the field size. By select-

ing zoom and mooz factors that are inverses of each other, the mooz command will exactly "undo" a zoom (restoring the field to its original size).

Confirm Before Zooming controls whether or not to use the "zoom confirmation check" when performing a "stretchy box" zoom (described in Section 1.4.1 on page 5). If "Confirm Before Zooming" is turned on, a dialog box will appear after each stretchy box operation, asking if you want to accept or cancel the zoom.

Preset Field Sizes is where you can enter the field sizes to be used for the "Go To Field Size 1" and "Go To Field Size 2" commands, described in the previous section. Enter degrees, minutes and seconds, separated by at least one blank space.

8.8 Auto Zoom and Auto Mooz

These commands will increase or decrease the field size by a preset factor. "Mooz" is the opposite of zoom. Refer to the previous section, "Zoom / Preset Options," for instructions on setting these values.

8.9 Undo Last Zoom

This will reset the size and location of the field to what it was prior to the last "stretchy box" zoom. See Section 1.4.1 on page 5 for a description of the stretchy box method of zooming.

The field will be restored regardless of how many non-zoom operations (pan, set field size, set field center, locate, etc.) were performed since the last zoom.

Note: This will only restore the field to what it was prior to a "stretchy box" type of zoom, *not* an Auto Zoom.

Suppose you have a 10-degree field currently displayed, and you want to see detailed views of various areas of that field. You can zoom in at some spot on the field (using the stretchy box method), then execute "Undo Last Zoom" to get back to the original field. Then zoom in on a different area, and perform another "Undo." And so on.

Note that this is different from the "Go To Previous Field Size" command described in Section 8.5 on page 78. Whereas that command only restores the field size, Undo Last Zoom will also restore the center coordinates of the previous field.

8.10 Face North, Face South, Face East, Face West, and Look Up

These commands will automatically set the field of view to 100° and set the orientation to Zenith Up. This provides a quick means of displaying a wide-field of view, oriented as it would appear to an observer standing on the ground looking in the specified direction.

8.11 Pan

Panning will cause the field to shift in the direction specified (Up, Down, Left or Right). These commands are included in the menu mainly as a formality. It is much more convenient to use the keyboard arrow keys or toolbar buttons to perform panning functions.

8.12 Set Pan Overlap

This dialog box lets you select how far the field will shift when the display is panned. The values range from 0.0 to 0.9. An overlap value of “0.3” means that the display will move 70% of the field size, giving a 30% overlap. A value of “0.0” means there will be no overlap when panning, and the field will shift one entire field height or width.

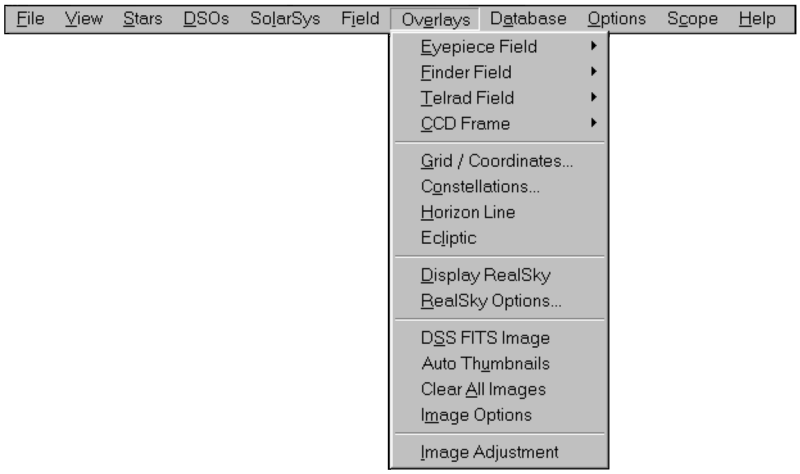
8.13 Field Size/Location Toolbar

a / b / c / d. Pan up / down / left / right (8.11).
e. Zoom in (8.8).
f. Mooz (Zoom out) (8.8).
g. Go to previous field size (8.5).
h. Go to preset field size 1 (8.6).
i. Go to preset field size 2 (8.6).
j. Undo zoom (8.9).
k. Display “Set Field Size” dialog box (8.4).
l. Display “Set Center Coordinates” dialog box (8.2).
m. Display “Locate Object” dialog box (8.1).

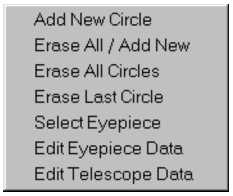
8.14 Field Orientation Toolbar

These commands are discussed in Section 8.3 and Section 8.10.
a. Display “Orientation” dialog box.
b. Rotate field counterclockwise.
c. Rotate field clockwise.
d. Display Rotation Tool.
e. Set North up.
f. Set South up.
g. Set Zenith up.
h / i / j / k / l. Look North / South / East / West / Up.
m. Invert field.
n. Mirror-image field.

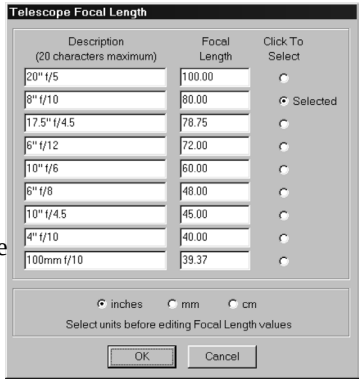
Chapter 9. Overlays



9.1 Eyepiece Field



The Eyepiece Field submenu contains options for plotting a circle representing an eyepiece field of view.



Before using this feature, you must enter the focal length of your telescope(s). Select the **Edit Telescope Data** menu to enter this information. In the Telescope Focal Length dialog box, you can enter data for up to nine different telescopes. First choose the units you want to use (inches, mm or cm) for the focal lengths. After entering the focal length(s) and optional description(s), select the telescope that you want to be currently active. Note: A valid number must appear in each Focal Length text box, but any or all of the Description fields may be left blank.

9.1.1 Entering Eyepiece Data

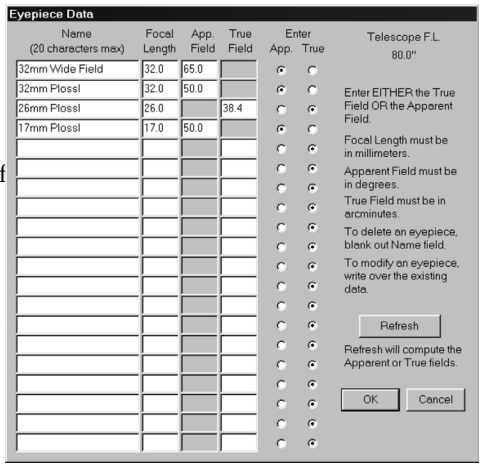
The next step is to enter the data for your eyepieces by selecting the **Edit Eyepiece Data** menu. In the Eyepiece Data dialog box, the currently selected telescope focal length will appear at the upper right. Make sure that this is correct.

In order to plot a circle of the proper size, MegaStar must know the true field of view of an eyepiece. The field of view will depend upon the focal length of the telescope, in addition to the eyepiece parameters. The “standard” formula for computing

the field size is:

FOV = AF / TFL / EFL
where FOV = true field of view in degrees
AF = apparent field of eyepiece in degrees
TFL = telescope focal length
EFL = eyepiece focal length
(TFL and EFL can be in any units, but they must be in the same units.)

Most eyepiece manufacturers will specify both the focal length (usually in mm) and apparent field (usually in degrees) for an eyepiece. So if you enter that information in the Eyepiece Data dialog box, MegaStar will be able to compute the field of view. If you change your telescope selection, the field of view will be recalculated automatically.



The above formula will work fine for most eyepieces. But it may not yield accurate results for the exotic ultra-wide-field eyepieces which have been introduced in recent years. Although most manufacturers still specify the apparent field for those eyepieces, it is not always valid for use in the above formula. Therefore, an alternate way to specify the eyepiece field is provided: You can enter the true field of the eyepiece directly (rather than using the indirect method of specifying the apparent field). To do this, you of course must know what the actual field of view is (which will depend upon the telescope used). The most accurate method for determining the true field of view of an eyepiece is to locate a star near the celestial equator, and place it at the edge of the field. Then turn off the telescope drive and let the star drift across the field. Make sure it is oriented so that the star passes through the center of the field. Time the number of minutes it takes for the star to traverse the field and divide it by 4. That will be the true field size in arc-minutes.

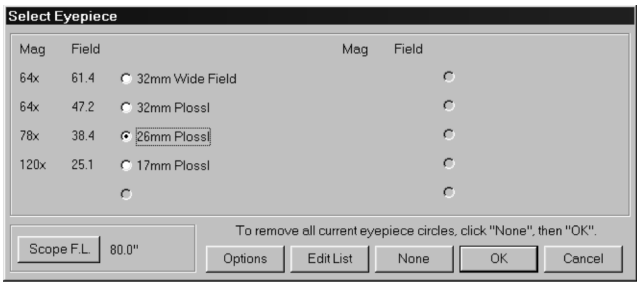
When you enter eyepiece data, specify either the apparent field or the true field (you cannot enter both). Click the appropriate radio button for the value you want to enter. After entering values, you can click the **Refresh** button. This will cause whichever parameters were left blank (either true or apparent fields) to be filled in by computing the values using the selected telescope focal length.

Since the eyepiece field of view depends on the telescope focal length, what happens if you specify the true field and then change the telescope selection? Here is how MegaStar handles that situation: If you specify the true field of the eyepiece, an apparent field will be calculated from that. That value will then be used to compute the new field of view whenever the telescope selection is changed. The apparent field

that is calculated from the true field may not match the manufacturer's specification, but it will be a value that yields a correct result for the true field when a new telescope focal length is selected.

9.1.2 Selecting an Eyepiece

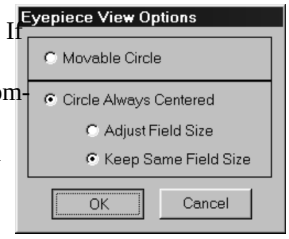
The first step in displaying an eyepiece field circle is to select the eyepiece you want to use. The **Select Eyepiece** menu option displays a dialog box which will show all of the eyepieces which you have previously entered. The currently selected telescope focal length appears at the lower left. You can change this by clicking the **Scope F.L.** button.



To the left of each eyepiece entry, the magnification and field of view (in arc-min) are shown.

An **Edit List** button is provided for modifying the eyepiece list. This will display the Edit Eyepiece Data dialog box described in the previous section.

The **Options** button displays a dialog box for selecting the behavior of the eyepiece field overlay. If **Movable Circle** mode is selected, then you will be able to plot the circle anywhere on the field. When a command to add a new circle is executed, the normal cursor will disappear and be replaced by a white circle having a diameter that matches the eyepiece field. Use the mouse to move this circle to the desired spot, and then click the left mouse button to "freeze" it in place. If you click the right mouse button instead, that will cancel the operation and the cursor will return to normal. The other mode is **Circle Always Centered**. In this mode, the circle will automatically be plotted at the center of the field. If the **Adjust Field Size** option is selected, the field will automatically resize to match the eyepiece field of view. Otherwise, the eyepiece circle will be drawn without altering the current field size. If, however, the current field is too small, it will automatically be enlarged to accommodate the eyepiece field.



When you click **OK**, an eyepiece field circle will be displayed (using the selected plotting mode).

9.1.3 Displaying Eyepiece Circles

When executing a command to plot an eyepiece overlay, if "Movable Circle" mode has been selected, the normal cursor will disappear and be replaced by a white circle having a diameter that matches the eyepiece field. Use the mouse to move this circle to the desired spot, and then click the left mouse button to "freeze" it in place. Click-

ing the right mouse button will cancel the operation and the cursor will return to normal. The eyepiece circle will remain fixed at that RA and Dec location, even if you change the field coordinates.

If "Circle Always Centered" mode has been selected, the circle will automatically be drawn at the center of the field. It will remain plotted at the center of the field even if the field is moved.

The **Add New Circle** menu function will plot a new eyepiece overlay, without erasing any previously plotted circles. If the plotting mode is "Movable Circle" (as opposed to "Circle Always Centered"), you can plot up to 10 eyepiece circles. **Note:** All concurrent eyepiece circles must be for the same eyepiece. If there are existing circles and you change eyepieces, the existing circles will be redrawn to reflect the new field of view.

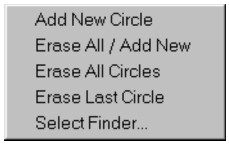
The **Erase All/Add New** menu function will erase any previously displayed circles before plotting the new one.

Erase Last Circle will erase the most recently created circle.

Erase All Circles will erase all circles, without creating a new one.

The **color** and **line style** of the eyepiece circles can be set in "Options | Symbols & Lines" (Section 11.2 on page 100).

9.2 Finder Field



The Finder Field submenu contains options for plotting a circle representing the field of view of a finder scope.

Before using this feature, you must enter the field of view of your finder scope(s). **Select Finder** will display a dialog box for entering these values (in degrees), along with an optional description of the finder. Select the finder you want to be currently active by clicking one of the radio buttons. Note: A valid number must appear in each Field Size text box, but any or all of the Description fields may be left blank.

9.2.1 Displaying Finder Circles

When a command to plot a finder overlay is executed, the normal cursor will disappear and be replaced by a white circle having a diameter that matches the finder field. Use the mouse to move this circle to the desired spot, and then click the left mouse button to "freeze" it in place. Clicking the right mouse button will cancel the operation and the cursor will return to normal. The finder circle will remain fixed at that RA and Dec location, even if you change the field coordinates.

The **Add New Circle** menu function will plot a new finder overlay, without erasing any previously plotted circles. You can plot up to 10 finder circles. **Note:** All concurrent finder circles must be for the same finder. If there are existing circles and you change finders, the existing circles will be redrawn to reflect the new field of view.

The **Erase All/Add New** menu function will erase any previously displayed circles before plotting the new one.

Erase Last Circle will erase the most recently created circle.

Erase All Circles will erase all circles, without creating a new one.

The **color** and **line style** of the finder circles can be set in "Options | Symbols & Lines" (Section 11.2 on page 100).

9.3 Telrad Field

The Telrad Field submenu contains options for plotting circles representing Telrad rings. The Telrad consists of three concentric circles which are nominally 0.5º, 2.0º and 4.0º in diameter.

When a command to plot a Telrad overlay is executed, the normal cursor will disappear and be replaced by a white circles having diameters that match the Telrad rings. Use the mouse to move these circles to the desired spot, and then click the left mouse button to "freeze" them in place. Clicking the right mouse button will cancel the operation and the cursor will return to normal. The Telrad circles will remain fixed at that RA and Dec location, even if you change the field coordinates.

The **Add New** menu function will plot a new Telrad overlay, without erasing any previously plotted circles. You can plot up to 10 Telrad overlays.

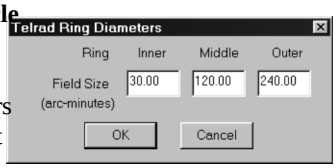
The **Erase All/Add New** menu function will erase any previously displayed overlays before plotting the new one.

Erase Last Circle will erase the most recently created overlay.

Erase All Circles will erase all Telrad overlays, without creating a new one.

The **color** and **line style** of the Telrad circles can be set in "Options | Symbols & Lines" (Section 11.2 on page 100).

It has been noted by members of the Amarillo Astronomy Club that not all Telrads are created equal. When several Telrads were compared, they found some variation in the diameters of the rings. The **Set Circle Diameters** menu function will display a dialog box for modifying the nominal angular diameters of the Telrad rings. You can measure the ring diameters for your particular Telrad by timing how long it takes a star at the celestial equator to drift across a ring. Divide the number of minutes by 4 to compute the diameter in arc-minutes. Enter those values in the dialog box.



9.4 CCD Frame

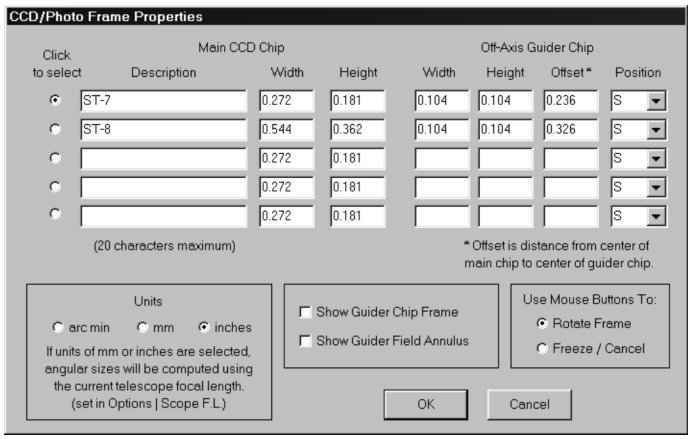
The CCD Frame submenu contains options for plotting a rectangular overlay representing the field of view of a CCD camera (or film frame, or any other imaging device).

The **color** and **line style** of the CCD frame can be set in "Options | Symbols & Lines" (Section 11.2 on page 100).

Before using this feature, you must enter the properties of your CCD camera. This is described in the following section.

9.4.1 CCD Properties

Use this dialog box to specify the size of your CCD frame and select options for how to display the frame.



First select the units you want to use for entering the dimensions. You can choose either angular units (arc-minutes) or linear units (inches or mm). If you plan to use the CCD camera with multiple telescopes having differing focal lengths, you should choose linear units. That way, MegaStar can automatically recompute the angular size of the frame when a different telescope is selected.

Data for up to five different cameras can be entered. Note that a valid number must be entered in each of the Width and Height text boxes, but any or all of the Description fields may be left blank. If your CCD camera has a built-in off-axis guider chip, you can optionally enter that information.

When a command to plot a CCD frame is executed, the normal cursor will disappear and be replaced by a white rectangle having the same angular dimensions as the CCD frame. The frame can be positioned by moving the mouse.

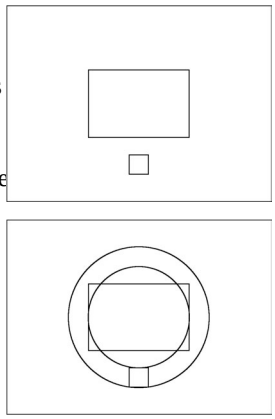
There are two options in the dialog box below **"Use Mouse Buttons To:**." If **Rotate Frame** is selected, then pressing the mouse buttons will cause the frame to rotate. If you press the Escape key, the operation will be cancelled and the frame will disappear. Pressing any other key will "freeze" the frame in place. If you do not need the ability to rotate the frame, then you can select **Freeze/Cancel** as the mouse button actions. In this mode, the left mouse button will freeze the frame in place, and the right button will cancel the operation. In either mode, the frame will remain fixed at that RA and Dec location, even if you change the field coordinates.

9.4.2 Displaying an Off-axis Guider Frame

If your CCD camera has a built-in off-axis guider chip, you can display that frame along with the main CCD frame. Being able to view the area covered by the guider chip can aid in acquiring a suitable guide star. You will need to enter the width, height and offset of the guider chip. The "offset" is the distance from the center of the main

chip to the center of the guider chip. You must also specify the orientation of the guider chip relative to the main chip (north, south, east or west).

There are two options for displaying the area covered by the guider chip. If **Show Guider Chip Frame** is selected, a single discrete rectangle will be displayed, as shown in the upper figure. If the main CCD frame is rotated, the guider frame will rotate along with it. If **Show Guider Field Annulus** is selected, then a ring will be displayed, representing the full area that the guider frame can cover if it is rotated.



Note that the guider frame will only be visible during the placement phase of the CCD overlay operation (while it is still movable using the mouse). Once the CCD frame is frozen in place, the guider frame will disappear.

9.4.3 Displaying CCD Frames

CCD Frame submenu has commands for displaying and removing frames.

The **Add New** menu function will plot a new CCD frame, without erasing any previously plotted frames. You can plot up to 10 frames.

The **Erase All/Add New** menu function will erase any previously displayed frames before plotting the new one.

Erase Last Frame will erase the most recently created frame.

Erase All Frames will erase all frames, without creating a new one.

The **color** and **line style** of the frames can be set in “Options | Symbols & Lines” (Section 11.2 on page 100).

9.5 Grid/Coordinates

With this dialog box, you can select how you want to label the coordinates on the screen display. Any combination of top, bottom, left and right can be selected. But in order for the labels to be shown, **Show Coordinate Labels** must also be selected.

Show Grid Lines will overlay an equatorial coordinate grid on the field. You can select one of three options for the **Grid Spacing**: Fine, Medium or Coarse. It is useful to turn the grid on when displaying fields that are very far north or south in declination, where the declination lines become much more curved. This will help you to orient yourself.

Show Center Marker will place a cross at the center of the field. This marker can be used to provide a reference point when making fine adjustments to the field position, using the mouse to recenter the field. Double-clicking the left mouse button will center the field at that point. Or you can right click the mouse to display the context menu, and select “Center Here.”

9.6 Constellation Figures & Boundaries

Options are provided for displaying constellation lines, boundaries and labels. Note that constellation lines will not be displayed if the field is smaller than 3 degrees.

9.7 Horizon Line

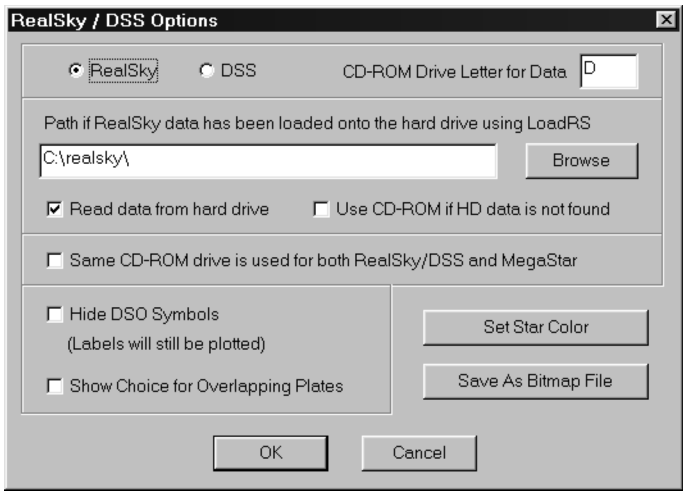
This will toggle the display of a local horizon line, referenced to the date and time selected in "Options | Set Date / Time."

9.8 Ecliptic Line

This will draw a line representing the ecliptic.

9.9 RealSky® Options

If you have the RealSky or Digitized Sky Survey (DSS) CD-ROMs, you can display these images in MegaStar. Although this feature is included in the Overlays menu, the images are actually displayed as "backgrounds" of the MegaStar field.



Select either **RealSky (**18 CD-ROM set**)** or **DSS** (102 CD-ROM set).

If you are reading the data directly from the CD-ROMs, enter the drive letter in the **CD-ROM Drive Letter for Data** text box.

Select **Same CD-ROM drive is used for both RealSky/DSS and MegaStar** if you are accessing both the MegaStar data and image data from the same CD-ROM drive. This will inform MegaStar to prompt you for the switching of CD-ROMs.

Hide DSO Symbols. This is different from the "DSOs | Hide DSOs" option. When this option is selected, DSO symbols will not appear on the field, but you can still display the labels. This will cause the objects in the RealSky image to be labeled. And even though the symbol is not plotted, you can still left click on DSOs in the image to bring up a data box (if there is an object in MegaStar's database at that loca-

tion).

Show Choice for Overlapping Plates. When you display a field that is near a plate boundary, there may be more than one plate which will cover that area. Often one of those plates will be of better quality than the other. In some cases, the plate edges can have very poor or corrupted data. With this option, a list of the alternate plates will be displayed, and you can choose which one to use. But depending upon the area of the sky you are working in, the plate selection dialog box can appear quite often when this option is turned on. This can become quite annoying. Here is a suggestion for how to optimally use this option: First, note the hot key (which you can change) that has been assigned to this option. This provides a quick way of turning it on and off. Leave this option off normally. Then when you run into a bad plate, turn the option on and then redisplay Realsky by turning it off and on again. If any alternate plates are available, then the selection dialog will be displayed and you can try a different plate. After a good plate is found, turn the option off until you encounter another bad plate, and then hit the hot key again.

Set Star Color. Stars do not show up well against the RealSky background in their normal white color. This option lets you change the star color. This color will only be used when an image is being displayed. Also, you may find it preferable to use the "Stars | Shrink" option when displaying stars against a RealSky image.

Save Bitmap To File. This allows you to save the image as a bitmap (.BMP) file. This will only save the image, not any of MegaStar's overlays. For the latter, you can use the Windows "<alt>PrintScreen" function to place an image of the MegaStar window into the clipboard.

9.9.1 Putting RealSky On Your Hard Drive

If you frequently move around the sky with RealSky displayed, the need to swap CD-ROMs can become annoying. This can be avoided by putting the RealSky data onto your hard drive. To do this, you will need to use the **LoadRS.exe** program which can be found in the \utilities folder of the MegaStar CD-ROM. Run this program by double-clicking the LoadRS.exe file in Windows Explorer, or by using the Run command in the Start menu. Click on "Help | Tutorial" in LoadRS for instructions. To load the entire RealSky onto your hard drive will require about 11 GB of free disk space. However, you can load only a portion of the sky if you want. After placing the data on the hard drive, select the **Read data from hard drive** option in the RealSky Options dialog box. You must also enter the path on the hard drive where the data has been loaded. A "Browse" button is provided for navigating the hard drive folders. If only a portion of the RealSky has been loaded, you may want to also select the option **Use CD-ROM if HD data is not found**. MegaStar will then try to access the data from the CD-ROM drive if the data is not found on the hard drive.

9.10 Display RealSky

This will display RealSky or DSS images for the current field. This option will remain active until you turn it off. As you change the field size and/or location, the image will be automatically reloaded and displayed for that field.

Note that the maximum size for a RealSky/DSS image is one degree. Therefore, if the field you are displaying is larger than one degree, the image will only partially cover the field.

If you wish to view the RealSky image with the colors reversed (i.e., black images aganst a white background), put MegaStar into "Chart Mode," which can be found in the "Options" menu (Section 11.7 on page 102). Sometimes faint detail will show up better in this mode.

Note: RealSky images will **not** be displayed if the field size is smaller than 3 arc-minutes or larger than 6 degrees. If your image "disappears," check the field size.

9.11 DSS FITS Image

The Space Telescope Science Institute has a web page where DSS images can be downloaded as FITS (Flexible Image Transport System) files. The URL for this page is http://archive.stsci.edu/cgi-bin/dss_form. These images can be imported into MegaStar. When you select this menu option, a file selection dialog box will be displayed. Choose the FITS file you want to display, and MegaStar will automatically center the field on the image and display it. The image will remain displayed until you load a new image, or select "Clear All Images" from the Overlays menu.

Note: There are other web pages where you can download DSS FITS files (such as SkyView), but MegaStar only supports the format from the web page cited above.

9.12 Auto Thumbnails

MegaStar includes more than 78,000 small "thumbnail" images of selected deep sky objects. When this option is enabled, the image will be displayed automatically whenever you locate a DSO (if an image is available for that object). The image will remain displayed until another "Locate" command is issued, or until you select "Clear All Images" from the Overlays menu.

You can also display thumbnail images manually using the context menu that is displayed when you right click on a DSO data box (Section 4.6 on page 34). An asterisk next to the object type in the data box indicates that an image is available.

Note: Images will **not** be displayed if the field size is smaller than 3 arc-minutes or larger than 6 degrees. If your image "disappears," check the field size. Also, the "Thumbnail Image" option will not appear in the data box context menu if the field is too small or too large for images to be displayed.

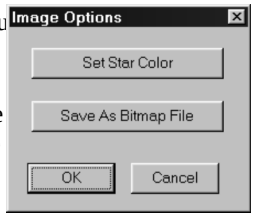
The image data file ("thumbnail.dat") can be accesed from the MegaStar CD-ROM, or you can copy it to the hard drive for better performance. Use the "File | Select Directories" dialog box (Section 3.8 on page 31) to specify the location of the image file.

9.13 Clear All Images

This will remove all DSS FITS or thumbnail images that have been displayed. This will have no affect on the RealSky display.

9.14 Image Options

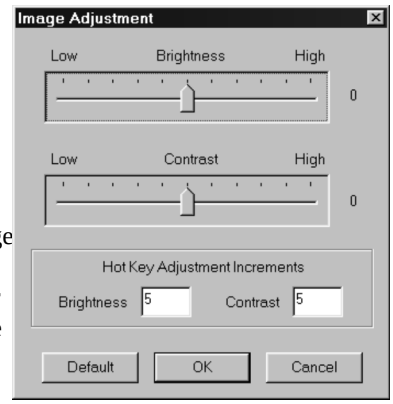
These options apply only to DSS FITS and thumbnail images.



Set Star Color. Stars do not show up well against images in their normal white color. This option lets you change the star color. This color will only be used when an image is being displayed.

Save Bitmap To File. This allows you to save the image as a bitmap (.BMP) file. This will only save the image, not any of MegaStar's overlays. For the latter, you can use the Windows <alt>PrintScreen function to place an image of the MegaStar window into the clipboard.

9.15 Image Adjustment



These brightness and contrast controls apply to any image displayed in MegaStar (RealSky, DSS, DSS FITS or thumbnail).

Drag the slider controls to adjust the brightness or contrast of the image. The image will not refresh until the mouse button is released from the slider control.

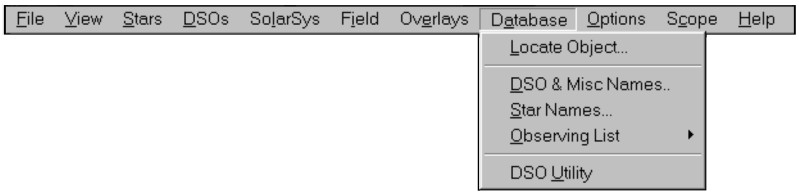
The **Default** button will reset the image to its "normal" unmodified state.

You can also set hot keys to increase or decrease the brightness and/or contrast. The **Hot Key Adjustment Increments** will determine the amount of change that occurs for each key press. A smaller number will result in finer control of the image adjustment. When using the hot keys, the image will be continuously refreshed while a key is held down.

9.16 Field of View Guide Toolbar

a. Add Telrad overlay.
b. Remove all Telrad overlays.
c. Add finder overlay.
d. Remove all finder overlays.
e. Add CCD frame.
f. Remove all CCD frames.
g. Add eyepiece overerlay.
h. Remove all eyepiece overlays.
i. Select an eyepiece.

Chapter 10. Database



10.1 Locate Object

Enter the designation of the object you want to locate, and the field will be centered on that object.

The text you enter is not case sensitive. All blank spaces are ignored, so you can omit any embedded blanks.

For example, to find NGC 7293, you could enter any of the following:

NGC 7293
ngc7293
ngc 7293
n7293

Section Appendix B on page 125 lists the catalog descriptions that are contained in the database. In some cases there is an abbreviation that can be used, such as “B” for “Barnard” or “N” for “NGC.” You must type the name or abbreviation exactly as it appears in that list (except for the case).

The **Locate** function can also be used to locate:

- Common names (DSOs and stars)
- Constellations (using the 3-letter abbreviation in Appendix A)
- Sun, Moon, and planets
- SAO stars (e.g., “SAO 1234”)
- HD stars (“HD 1234”)
- GSC stars (“GSC 1234:1234” or “GSC 1234-1234”)
- Tycho stars (“TYC3105:2070:1”)
- Hipparcos stars (“HIP1234”)
- PPM stars (“PPM1234”)
- Flamsteed numbers (“61 cyg)”
- Bayer designation (“espilon lyr”)

Refer to Section 5.10 on page 43 for instructions on how to locate variable stars, and Section 5.12 on page 45 for locating double stars.

If you click on the down arrow at the right of the Designation text box, a list of the ten most recent names will be displayed. Highlighting one of these will place that name in the text box, providing a convenient means of relocating previous objects. Each time a new object is located, it will update the “recent list.”

10.2 DSO & Misc Names

This will display a list dialog box containing common names of objects (primarily deep sky objects). To locate an object in the list, double-click on the entry or highlight it and click the **Locate** button.

You can change the font of the text in the list box by clicking the **Set Font** button.

10.3 Star Names

This will display a list dialog box containing common names of stars. To locate a star in the list, double-click on the entry or highlight it and click the **Locate** button.

You can change the font of the text in the list box by clicking the **Set Font** button.

10.4 Observing List

An Observing List is a special type of file used by MegaStar for storing a list of objects which you have compiled. Preparing an Observing List in advance can make your observing session more efficient. It will enable to quickly locate and view your target objects in MegaStar. Section 10.4.1 on page 94 describes how these lists can be created, and Section 10.5 on page 95 explains how you can use these lists.

When you click "Database | Observing List" in the main menu, a popup menu containing three submenus appears.

View Current List will display the contents of your currently selected Observing List. This will always be the most recently selected list, even if it was selected in a previous session. **Note:** Do not execute this function until you have created at least one Observing List!

Select Existing List will display a file selection dialog box. Only Observing List files (having a file extension of ".obs") will be shown. Once a list has been selected, it will remain the current list until a different one is selected or a new one is created. After you select a file, the contents of that Observing List will be displayed in a Data Listing Window.

Create New List will create a new empty Observing List. A file selection dialog box will be displayed, where you can type the name of your new Observing List file. The file extension *must* be ".obs".

10.4.1 Building Observing Lists

There are two methods for building Observing Lists:

Method 1: From one of MegaStar's object listing utilities.

Each of the following listing functions will display an object list in a Data Listing Window (Section 10.5 on page 95). To save the list as an Observing List for future use, click the **Save Obs List** button. Then give it a name in the file selection dialog box.

DSOs | DSO Utility. Section 6.9 on page 56 describes the DSO Database Utility, which can create a list of objects based upon selected filtering parameters.

DSOs | Screen Listing. This function will display a list of all the DSOs in the current field.

Stars | List Variables. This will list all variable stars in the currently displayed field.

Stars | List Doubles. This will create a list of double stars based upon selected filtering parameters. This is described in Section 5.13 on page 45.

Method 2: Add Specific Objects Manually. For this method, you must first create an empty list by clicking "Database | Observing List | Create New List." Or you could select an existing Observing List, in which case the objects you add will be appended to the end of that file.

Left click on an object to display its data box. Then right click on the data box to display the context menu. One of the menu selections will be "Add to Observing List." This will add that object to your Observing List file.

You only need to select your Observing List file once. All subsequent "Add to Observing List" operations will continue adding to that list.

The Observing List can contain DSOs, stars, double stars and variable stars. You cannot insert solar system objects.

10.5 Data Listing Windows

Most of MegaStar's functions which generate an object list will use the Data Listing Window for the presentation of the data. This window contains several options. Depending upon what type of data is being listed, some of those options may not be applicable. Any options which are invalid for the type of data presented will be disabled ("grayed"). For example, the "Show These DSOs Only" option cannot be used if the window is displaying a list of double stars or variable stars.

One component of these lists which is common to all object types is the coordinates, which will always begin in column 62 and have the following format:

hh mm ss.s ±dd mm ss

where h=hours, d=degrees, m=minutes and s=seconds. The data which precedes the coordinates will vary depending upon the object type.

The sample Data Listing Window shown here is an Observing List which contains a mixture of DSOs, GSC stars, Tycho stars, variable stars and double stars. Each object type has a unique data format:

DSOs—Line 1 lists the designation(s). Line 2 is type-dependent:

Galaxy: magnitude, major axis, minor axis, p.a., morphological class.

Galaxy Cluster: mag 10th brightest, size, mag 3rd, mag 1st, # galaxies, class.

Open Cluster: magnitude, size, number of stars, mag of brightest star, class.

Globular: magnitude, size, mag V(tip), mag V(HB), B-V(tip), radial velocity.

Bright/Dark Nebula: magnitude, major axis, minor axis, classification.

Planetary Nebula: magnitude, size, magnitude of central star, class.

Double Stars—Line 1 lists the WDS designation and components. Line 2 contains magnitude of primary, magnitude of companion, separation in arc-sec for first

and last observation, p.a. for first and last observation, year of first and last observation, spectral class of primary and companion.

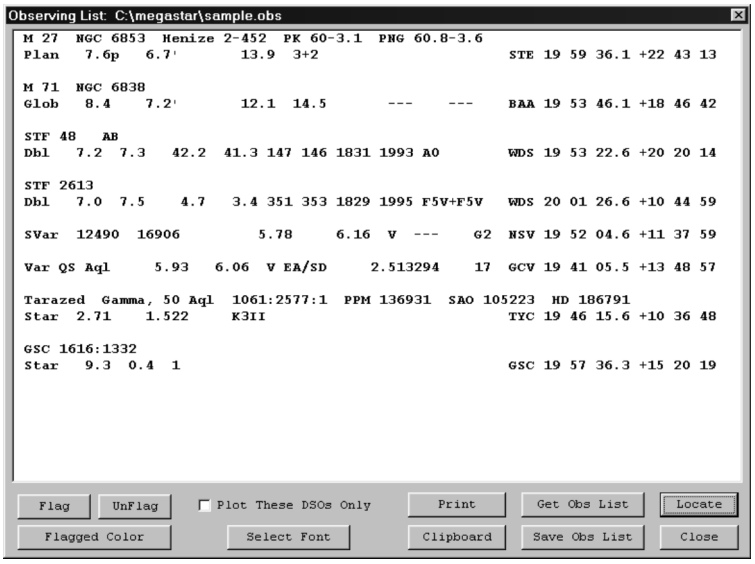
GCVS Variable Stars—GCVS designation, magnitude at minimum and maximum, magnitude type, variability type, period in days, duration of light increase from minimum to maximum.

NSV Variable Stars—NSV number, designation, magnitude at minimum and maximum, magnitude type, variability type, spectral class.

Tycho/Hipparcos Stars:—Line 1 lists common name, Bayer letter, Flamsteed number, Tycho/Hipparcos ID, PPM, SAO, HD number (some of these may not apply to a given star). Line 2 contains V magnitude, B-V, spectral class.

GSC Star—Line 1 lists GSC ID, Bayer letter, Flamsteed number, Tycho ID, PPM, SAO, HD number (some of these may not apply to a given star). Line 2 contains magnitude, magnitude uncertainty, bandpass filter code.

The buttons at the bottom of the Data Listing Window perform the following functions:



Locate—This will center the field on the highlighted object. You can also perform this function by double-clicking on the object's entry in the list.

Flag—This will place an asterisk ("*") in column 1 of the line that is highlighted. You can use this to keep track of which objects you have observed. For DSOs, this will enable that object to be plotted in a special color on the chart.

UnFlag—This will remove the asterisk from the highlighted line.

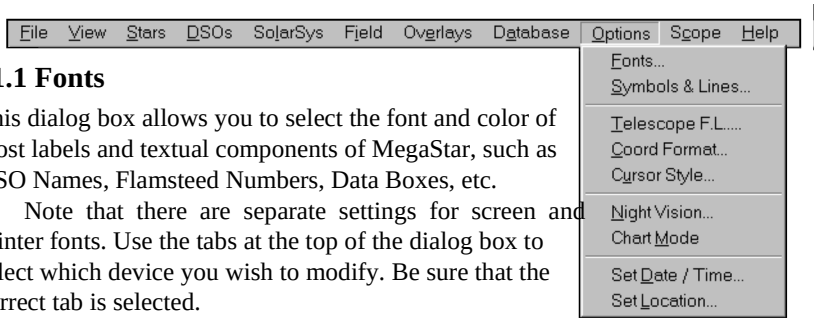
Flagged Color—This will select the color to use for plotting "flagged" DSOs. Note that this feature only applies to DSOs, and has no effect on stars, double stars or variable stars.

Plot These DSOs Only—If selected, MegaStar will only display those DSOs which appear in the list, regardless of the field size or any filter settings. This enables you to view your target objects without cluttering the field with extraneous DSOs. As with the flag color, this option only applies to DSOs, and has no effect on stars, double stars and variable stars.
Print—Print the list
Clipboard—Copy the list to the Windows clipboard.
Get Obs List—Displays a file selection dialog for choosing a new Observing List to display. All Observing Lists have a file extension of ".obs."
Save Obs List—This function is intended for use with data listings which are not already Observing Lists (those described in Section 10.4.1 on page 94). A file selection dialog box is displayed for saving the current list as an Observing List.
Select Font—Allows you to change the font of the Data Listing Window.

10.6 DSO Utility

This menu selection is identical to "DSO Utility" in the DSOs menu, described in Section 6.9 on page 56.

Chapter 11. Options

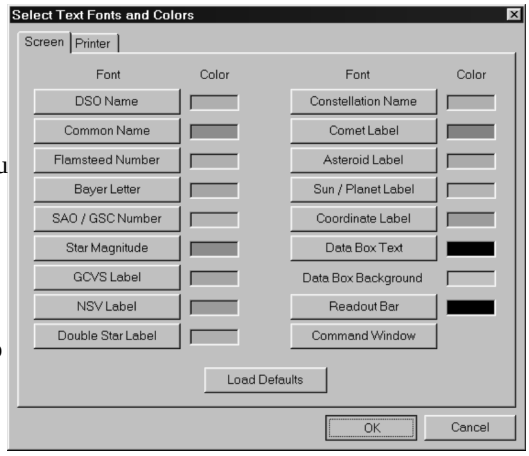


11.1 Fonts

This dialog box allows you to select the font and color of most labels and textual components of MegaStar, such as DSO Names, Flamsteed Numbers, Data Boxes, etc.

Note that there are separate settings for screen and printer fonts. Use the tabs at the top of the dialog box to select which device you wish to modify. Be sure that the correct tab is selected.

Although this dialog box has both "OK" and "Cancel" buttons, the changes you make will take affect immediately. The Cancel button will not undo your changes. These buttons are added by Windows automatically for this type of tabbed dialog box. Otherwise, the Cancel button would be removed.



Font. When a button (such as "DSO Names") is selected, a Windows font selection dialog box is displayed. Note that you are not constrained to the font sizes that are presented in the "Size" list box if the font is True-Type. For example, if the smallest listed font for Arial is "8", you could type a "6" into the text box. In many cases, only even-numbered point sizes are presented in the list, but you could type in an odd number.

After setting the desired font properties, click "OK" to set the font for that text. The MegaStar window in the background will refresh immediately to reflect the new font.

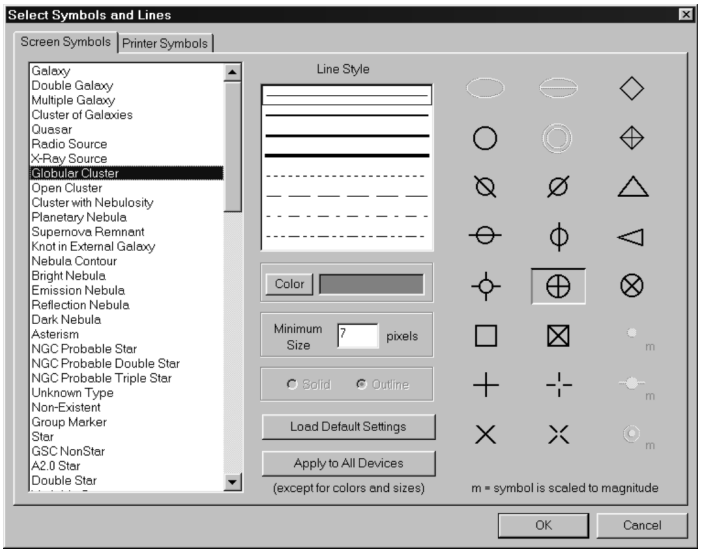
Color. To change a font color, click on the color bar for that item. A Windows color selection dialog box will be displayed. You can choose one of the "standard" colors, or you can click the "Define Custom Colors" button to create a new color. In the custom colors window, the "Add to Custom Colors" button will create a selection for that color in the "Custom colors" list. MegaStar will save your custom colors between sessions.

As with the font selection, the MegaStar window in the background will refresh immediately to reflect the new text color.

The **Load Defaults** button will reset all fonts and colors to the MegaStar default, and you will permanently lose any custom settings you have made.

11.2 Symbols and Lines

This dialog box will let you select the properties of object symbols and overlays in



MegaStar. Note that there are separate settings for the screen and printer. The tabs at the top of the dialog box allow you to select which device you wish to modify. Be sure that the correct tab is selected.

At the far left is a list of object types and overlay lines. Highlight the item that you wish to modify. Any settings which are applicable to that item will then be activated. Those setting which do not apply or are not allowed for that object will be disabled.

Note that MegaStar has three different categories of galaxies: galaxy, double galaxy and multiple galaxy. If you want all galaxy symbols to be the same, make sure that you make any changes to all three types. Similarly, there are separate entries for nebula contour, bright nebula, emission nebula and reflection nebula. Be sure to examine each of them to make sure that you have the desired settings.

Line Style. Click the desired line style. For solid lines, four thicknesses are available. You can also choose dotted, dashed or combination dot-dash lines. Note that Windows does not support the use of dotted or dashed lines having a thickness other than “one”. Also, the use of dashed and dot-dash lines is not recommended for use with the screen display. These line styles often give unsatisfactory results.

Color. Click the Color button to select the object color. A Windows color selec-

tion dialog box will be displayed. You can choose one of the "standard" colors, or you can click the "Define Custom Colors" button to create a new color. In the custom colors window, the "Add to Custom Colors" button will create a selection for that color in the "Custom colors" list. MegaStar will save your custom colors between sessions.

Minimum Size. For objects which have an unknown size in the database, this minimum size will usually be used for displaying the symbol. For the screen display, this size is specified in pixels. For the printer, it is specified in millimeters.

Solid / Outline. Select whether you want the symbol to be filled or outline only. Note that this option will not apply to every symbol type. For example, the solid option is meaningless for a "+" symbol.

Symbol. There are 24 symbols from which you can choose. A rectangle will be drawn around the symbol currently selected for an object. For most object types, the selection of symbols will be somewhat restricted. Those symbols which cannot be chosen for the selected object will be disabled.

The three symbols having an "m" to the lower right are handled somewhat differently than the others. Rather than being scaled based upon the size of the object, these symbols are scaled based upon magnitude. These are primarily reserved for stars, double stars and variable stars.

Load Default Settings. Click this button to return all settings to the MegaStar default. You will permanently lose any custom settings you have made.

Apply to All Devices. This will cause the settings of the current tab to be applied to the other tab as well. The screen settings will be applied to the printer, or vice versa. This will not affect the colors or minimum sizes, however.

11.3 Telescope F.L.

In the Telescope Focal Length dialog box, you can enter data for up to nine different telescopes. First choose the units you want to use (inches, mm or cm) for the focal lengths. After entering the focal length(s) and optional description(s), select the telescope that you want to be currently active. Note: A valid number must appear in each Focal Length text box, but any or all of the Description fields may be left blank.

This information will be used to compute the angular diameters of eyepiece fields and CCD frames.

11.4 Coordinate Format

This dialog box lets you choose the format for reporting celestial coordinates in certain components of MegaStar. This option will affect the Readout Bar, Data Boxes and Ephemerides. This will *not* affect object listings or the coordinate labels surrounding the field.

11.5 Cursor Style

You can choose from among 24 predefined cursor styles. This only affects the shape of the cursor when it is within the border of the field display. To preview your cursor selection, press the left mouse button over the desired cursor, and continue holding

the button down as you move the cursor outside of the dialog box. This will show you what that cursor will look like against the MegaStar field. When you have found the cursor you want to use, click "OK."

11.6 Night Vision

A "Night Vision" mode is available for using MegaStar in the field. You can choose light red, dark red, light gray, dark gray, or white. For most people, the best results are obtained by selecting the white or gray mode, and placing a red filter over the screen. This will provide the maximum contrast and best control of the screen brightness.

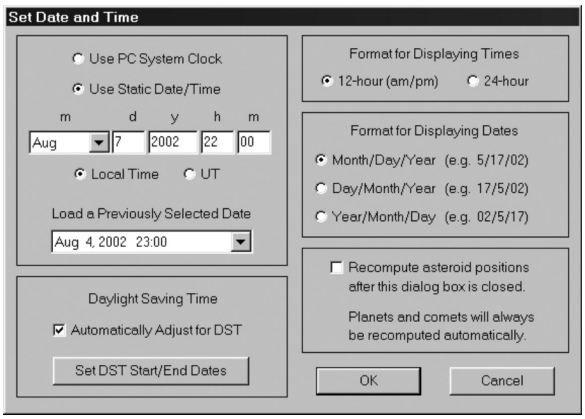
The red modes are not perfect. There will be some Windows system elements that will not change (such as system buttons and scroll bar buttons). Also, because color is a system-wide shared resource in Windows, night mode will have some effect on all other programs that are running.

If you exit MegaStar while in night vision mode, the system colors will be restored to their normal settings.

11.7 Chart Mode

This will change the background of the screen display to white. For most objects, the colors and symbols that have been selected for the printer will be used. The normal screen colors and symbols will be restored when chart mode is turned off.

11.8 Set Date/Time



This is the reference time used for the "Compute All Comet (or Asteroid or Planet) Positions" functions. It is also used in the calculation of altitude and azimuth in the Readout Bar, and the rise/set/transit times in object data boxes. The reference date and time can be displayed in the caption bar of the MegaStar window (refer to **Section 4.10 on page 37)**.

You can choose one of two reference time modes: The **System Clock** of the PC, or a **Static Date and Time** which will remain constant throughout your MegaStar session.

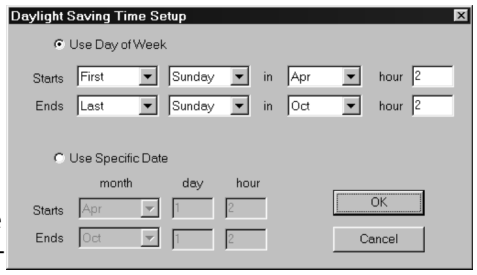
Whenever a new static date/time is entered (and accepted by clicking "OK"), it will be added to the list of **Previously Selected Dates**. You can click on this drop-down list to select and load a previously-entered date/time.

Format for Displaying Times lets you select your preference for the time for-

mat used in ephemerides, solar system labels, etc. Either 24-hour time or the use of am/pm can be selected. (Universal Time will always be expressed in 24-hour format.). **Format for Displaying Dates** lets you choose the date format.

Whenever the reference time is changed, all comet and planet positions will be automatically recomputed for the new time. However, because the computation for asteroids can be quite lengthy, there is an option for choosing whether to automatically recompute asteroid positions.

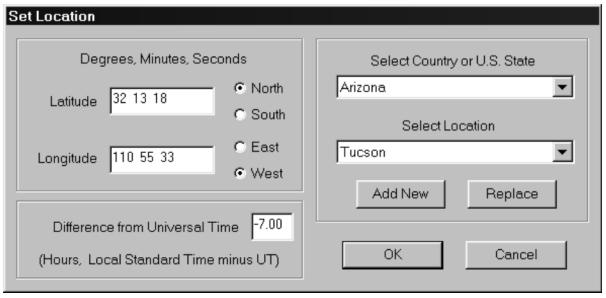
MegaStar will make adjustments for Daylight Saving Time if you select **Automatically Adjust for Daylight Saving Time**. The **Set DST Start/End Dates** button will display a dialog box for entering the "rules" for when DST starts and ends.



Note: All time-dependent calculations in MegaStar also require the proper setting of your location (latitude and longitude) and time zone. This is performed in "Set Location" described in the next section.

11.9 Set Location

Setting your location is necessary for calculating the correct altitude, azimuth, rise/set/transit times, and for accurate computation of solar system object positions.



You can enter your Latitude and Longitude directly, or you can select a location from the predefined list.

To enter Latitude and Longitude values directly, type these into the text boxes as degrees, minutes and seconds separated by at least one blank space. Decimal points are allowed in any of the numbers you enter. If the minutes or seconds are omitted, they will default to zero. Remember to select the appropriate hemisphere options (North or South, and East or West).

You must also specify the number of hours your local time differs from Universal Time (UT, or Greenwich Mean Time). This is expressed in hours, and it is your local time minus UT. This value will generally be *negative* for *western* longitudes, and *positive* for *eastern* longitudes. *Do not apply any current Daylight Saving Time correction to this value*. This value is always referenced to your local *standard* time.

To select a location from MegaStar's database, first click on the **Select Country**

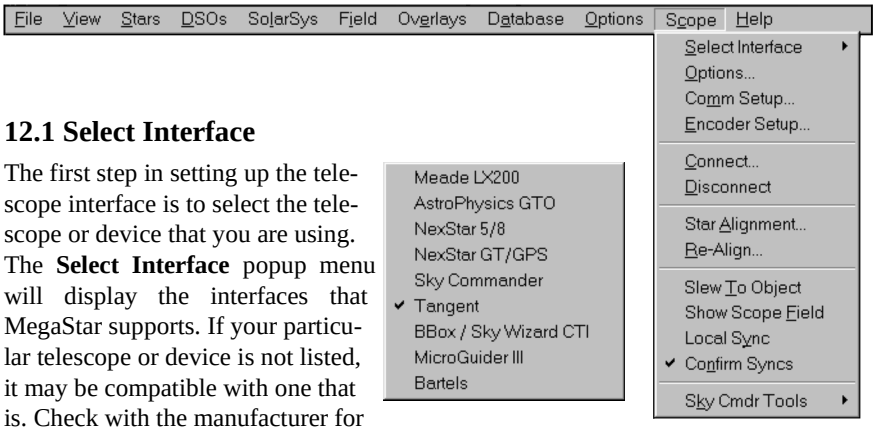
or U.S. State dropdown list and choose a state or country. Then click on the **Select Location** dropdown list to choose the city or location. The Latitude, Longitude and UT Difference text boxes will be updated with the values stored for that location. **Note:** Some of the UT offset values in MegaStar's database have been approximated, and may be incorrect due to the irregularity of time zone boundaries. *Therefore, be sure to check whether this value is correct for your location*.

To **modify an existing location**, manually enter the Latitude, Longitude and UT Difference in the text boxes, and then click the **Replace** button.

To **add a new location**, first enter the desired Latitude, Longitude and UT Difference, then click the **Add** button. A dialog box will be displayed for entering the name of your new location. That location will be added to the state or country list that is currently selected.

The first entry in the "Select Country or U.S. State" dropdown list is **User Defined Locations**. This list is initially empty. This can be a convenient place to store a list of locations that you use frequently.

Chapter 12. Scope

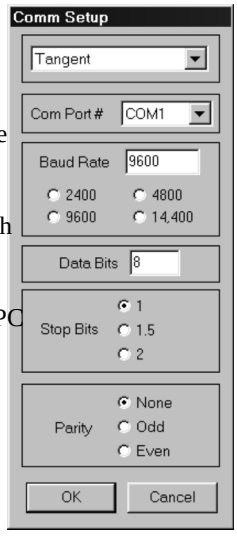


12.1 Select Interface

The first step in setting up the telescope interface is to select the telescope or device that you are using. The **Select Interface** popup menu will display the interfaces that MegaStar supports. If your particular telescope or device is not listed, it may be compatible with one that is. Check with the manufacturer for compatibility with other interfaces.

The **Tangent** selection refers to the family of units manufactured by Tangent Instruments, which are all identical in their operation. These include the NGC-MAX, Sky Vector, Advanced AstroMaster and Sky Wizard 3 (but *not* Sky Wizard CTI, which functions differently).

12.2 Communication Setup



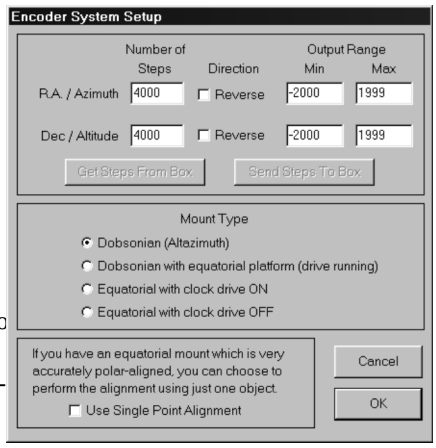
Before interfacing to your telescope, you must make sure that the communication parameters are set up correctly by clicking the **Comm Setup** menu option.

Enter the appropriate communication parameters in the dialog box. The most common settings are 9600 Baud, 8 Data Bits, 1 Stop Bit and No Parity. This information will be supplied by the manufacturer, except for the Com Port, which will depend upon the configuration of your PC. If you do not know which com port to use, try each one and see if a successful connection is achieved. If you are using a laptop or PC which has a PS/2 mouse, then the most likely com port number will be Com 1.

If your PC has a modem, you should find out which com port it uses, and avoid using the same one. To determine your modem's com port, open the Windows Control Panel and double-click on "Modems." Then click the "Properties" button in the dialog box and look for the Port number.

12.3 Encoder Setup

If you are using a device which interfaces directly with the encoders (such as the Tan-



gent devices), you will need to enter the encoder parameters by clicking the **Encoder Setup** menu option.

Number of Steps—Enter the resolution of your encoders, taking into account any gearing ratio your setup may have. For example, if you are using 4000-step encoders with a 2:1 gearing ratio, then the number of steps to enter would be 8000.

Direction—Depending upon how the encoders are mounted, you may need to specify a "reverse" direction. The best way to determine whether this is necessary is by looking at how the counts change when moving the two axes of the telescope mount. In the "Telescope Interface Options" dialog box (described in the next section), choose the "Raw Encoder" option for the readout window. Then establish the connection (Section 12.5 on page 108). The count values in the digital readout window should change as you move the telescope. The count should *increase* when the declination or altitude axis is moved *northward*. If the count decreases, then you need to select "reverse" for the Dec/Altitude encoder. The count should *increase* when you move the RA or azimuth axis *clockwise* as seen from above the telescope. If the count decreases, select "reverse" for the RA/Azimuth encoder. **Note:** These instructions should be reversed for the Southern Hemisphere.

Output Range—For Tangent, MG III, and some versions of BBox, the output range is -(steps/2) to +(steps/2-1). For example, if the encoders have 4000 steps, the output range would be -2000 to +1999. Other devices (such as certain BBox versions) may have a *fixed* output range (e.g., -4000 to +4000) which is *independent* of the encoder resolution. Consult the documentation for your interface device for the proper setup of the output range.

Send Steps To Box—For some devices, such as the MicroGuider III and BBox, you may need to transmit the encoder resolution to the device. If so, use this button for this purpose. **Get Steps From Box** can be used to verify that the correct resolution has been set.

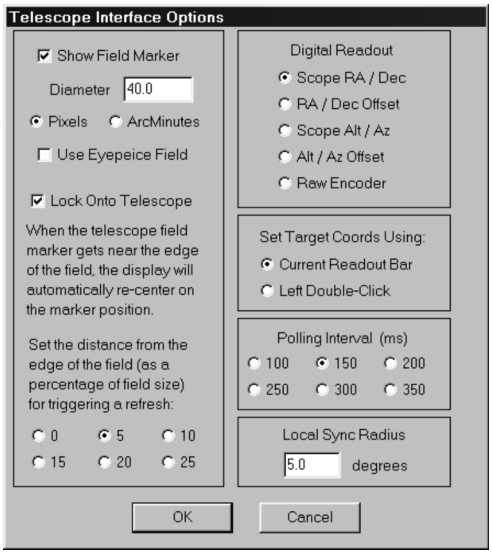
Mount Type—Select the type of mount that most closely matches your telescope. The need to specify whether a clock drive is running is only for the proper handling of the optional Field Marker, which indicate the telescope's position on the MegaStar field. If you are using a clock drive, but don't indicate that to MegaStar, then the Field Marker may tend to "jitter."

Use Single Point Alignment—If you are using an equatorial mount which you know is accurately polar-aligned, you can simplify the star alignment process by using only a single star. Indicate this by selecting this option.

12.4 Options

The last step before connecting to your telescope is to set some options. Depending upon your interface selection, one of two dialog boxes will be displayed.

The Options dialog box shown here is for the Tangent, BBox, Sky Commander and MicroGuider III. The dialog box for the LX200, NexStar and AstroPhysics GTO is not shown, but is very similar. For those interfaces, the "Target Coordinate Selection" and "Digital Readout" options are not used, but all of the other options described below are applicable.



Digital Readout— Select the information that you want the readout window to report.

The **Raw Encoder** option is useful for checking the integrity of your system (for example, detecting encoder slippage) and for determining the "direction" of the encoders.

Scope RA/Dec (intended for equatorial mounts) and **Scope Alt/Az** (for Dobsonian mounts) will simply show the coordinates that the telescope is pointing to. These values will be constantly updated as the telescope is moved. **RA/Dec Offset** and **Alt/Az Offset** are used if you want to locate an object. This tells the readout window to display the offset between the current telescope position and the coordinates of the selected target object. You then simply move the telescope until both offsets read "0."

The target object coordinates can be set in two ways, and the mode is selectable in the **Set Target Coords Using:** option. If **Current Readout Bar** is selected, the target coordinates will always be the current coordinates in MegaStar's Readout Bar (Section 4.9 on page 37). If **Left Double-Click** is selected, then you must *double-click* on the field with the left mouse button to set the target coordinates. This action will also re-center the field at that point. The latter option might be preferable, since there will be less chance of inadvertantly changing the target coordinates. Keep in mind that the Readout Bar coordinates change every time you single-click on the field with the left mouse button, locate an object, pan, or perform any other function that changes the field position.

Show Field Marker—For those interfaces which support continuous polling of the telescope position, you can choose to display a marker on the MegaStar field to indicate where the telescope is currently pointing. This marker will be a circle of selectable size. If the size is specified in **pixels**, the marker will have a constant diameter. If you specify **arc-minutes**, then the size of the marker will be scaled based on the cur-

rent field size (within lower and upper size limits). A third option is **Use Eyepiece Field**. In that case, the marker size will be set to the field size of the currently selected eyepiece. Refer to Section 9.1 on page 81 for information about eyepiece overlays.
Lock Onto Telescope—If you are displaying a field marker, this option can also be selected. For hands-free operation, the displayed field will "lock on" to the telescope position, and will automatically shift to follow the position of the telescope. The field will refresh whenever the marker gets within the specified distance from the edge of the field. If you perform a "Locate" or "Pan" operation, the field lock will be suspended. However, if the marker moves back into the field, it will lock on again automatically. Note that if you do not turn this option on, you can still manually center the field at the telescope position by clicking the **Show Scope Field** menu command.
Polling Interval—This determines how often MegaStar polls the interface for coordinate information. For example, if it is set to 250ms, then the unit will be polled four times per second. Decrease this value if the field marker does not respond quickly enough. Increase it if the interface appears to impact the performance of other programs that are running concurrently with MegaStar.
Local Sync Radius—This is used with the Local Sync option described in Section 12.8 on page 110. It determines the size of the area for which the local sync correction will be applied.

12.5 Connect

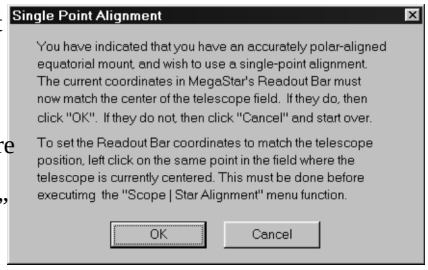
When you click **Connect** in the Scope menu, the message "Link Successful" will be displayed briefly when the connection has been established. What you see next will depend upon the type of interface. In the case of LX200, NexStar and AstroPhysics GTO, a menu bar will appear on the screen. For the Tangent, BBox, Sky Commander and MicroGuider III, a readout window will appear. For the latter devices, the next step will be to perform a star alignment. For the LX200, NexStar, AstroPhysics GTO and Sky Commander, you will not perform a star alignment within MegaStar.

12.6 Star Alignment

12.6.1 Single-Star Alignment

If you selected "Use Single Point Alignment" in the Encoder Setup dialog box, then the alignment procedure will be as follows:

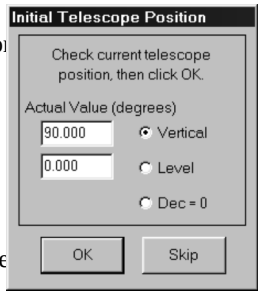
First, left click on the point in the field that the telescope is currently centered on (to set the Readout Bar coordinates). This will normally be some bright star, but it can be any arbitrary point that you can identify in the MegaStar field. Then select "Scope | Star Alignment" to display the dialog box shown at the right: If you are sure that the Readout Bar coordinates match the telescope position, click "OK." The alignment is now finished.



12.6.2 Two-Star Alignment

If "Use Single Point Alignment" in the Encoder Setup dialog box is not selected, a two-star alignment procedure will be performed. Use this for Dobsonian or non-polar-aligned equatorial mounts.

When you click "Scope | Star Alignment," the first dialog box that is displayed will be for setting the initial telescope position.



If you are using a Dobsonian mount, you should orient the optical axis to either a vertical or horizontal positio (the term "level" is used here, to conform with the NGC-MAX documentation). If that is not possible, or if you know the angle of the optical axis, you can enter that value in the text box. One method for doing this would be to center on a star and check the star's altitude in MegaStar. Then enter that altitude in the text box.

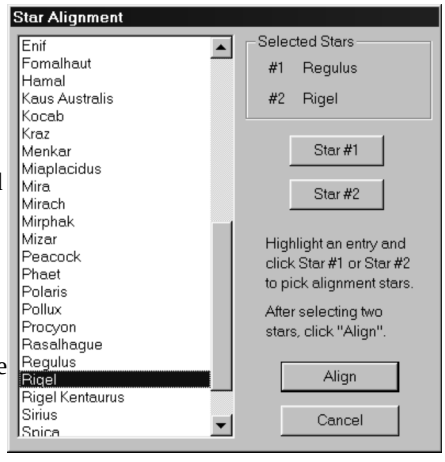
If you are using an equatorial mount, point the tele scope at the celestial equator and click the "Dec = 0" option. For this step, it may be helpful to point to a star that is very near the equator.

In this first step of the alignment procedure, the sequence of events is important and should be performed exactly as follows:

1. Orient the telescope to the desired initial position.
2. Power up the encoder interface device.
3. *Do not move the telescope after turning the unit on*. When the encoder interface is first powered up, the encoder counts are initialized to zero. This needs to correspond to the initial telescope position.
4. Click "Scope | Connect."
5. Click "Scope | Star ALignment."
6. Select the appropriate option in the "Initial Telescope Position" dialog box.
7. Click the "OK" button.

After you click "OK," the Star Alignment dialog box will be displayed. Follow these steps:

1. Choose the first alignment star by highlighting it in the list and clicking the **Star #1** button. Then choose a second star and click the **Star #2** button. You can replace existing selections, if necessary.
2. Click the **Align** button.
3. A message will appear on the screen asking you to center the first alignment star in the eyepiece, and then click OK.



4. After you have clicked OK in step3, a second message will appear, prompting you to center the second alignment star and then click OK.

If the alignment was successful, a "warp" factor will be displayed, indicating the accuracy of the alignment. Click "OK" to remove the message. The warp factor should be 0.5 or less (the smaller, the better). If the warp factor is too large, or if you receive a message indicating that the alignment was not successful, you will have to start over. After successful alignment, the readout window should then begin to display valid values for the readout mode that was selected in the Options dialog box.

12.7 Re-Align

If during the observing session the accuracy of the encoder readouts decreases, you will need to refine the star alignment. You could disconnect the link and re-do the two-star alignment. Or you can try Re-Align.

Re-Align uses only one point, and does not require setting the initial telescope position. The new alignment point will be used with one of the original alignment points. You can use any object that is currently centered in the telescope. Just click on that object with the left mouse button, and choose "Re-Align" from the Scope menu. It is very important to remember to click on the object first! Whereas the Local Sync is a temporary and limited adjustment, this will perform a permanent and global refinement of the alignment procedure.

12.8 Local Sync

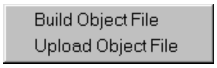
This will correct the inaccuracy of the telescope alignment in a localized area. For example, if you have an object centered in the telescope, but the field marker is not centered on that object, you can "sync" on it. Click on the object with the left mouse button, and then click the **Local Sync** menu option. *It is very important to remember to click on the object **before** executing the Sync command*! A linear correction will then be applied to the telescope readout and marker position.

The correction will be applied within a user-selectable radius of the "synced" object. This is the **Local Sync Radius** setting in the Telescope Interface Options dialog, described in Section 12.4 on page 107. If the telescope is moved outside of this area, the correction will not be applied.

If **Confirm Syncs** is checked in the Scope menu, a confirmation dialog box will be displayed whenever you perform a Local Sync.

12.9 Sky Cmdr Tools

This popup menu has two submenu items. These functions are used for the object upload feature of the Sky Commander.



12.9.1 Build Object File

This will convert a MegaStar Observing List file (refer to Section 10.4 on page 94) into a format suitable for uploading to the Sky Commander "Special Object Catalog." Enter the file name of the Observing List file and the Sky Commander output file.

There is a limit of 59 objects that can be uploaded to the Sky Commander.

12.9.2 Upload Object File

This will upload the selected object file to the Sky Commander "Special Object Catalog." Use the **Browse** button to select the desired file, then click the **Upload** button.

12.10 Slew To Object

If the telescope you are connected to has slewing capability (such as the LX200, NexStar and AstroPhysics GTO), this command will slew the telescope to the current coordinates in MegaStar's Readout Bar.

The Readout Bar coordinates are updated whenever the left mouse button is clicked within the MegaStar field, or when an object is centered using the "Locate" command. Thus to slew to NGC 4656, "Locate" that object (or click on it if it is already in the field), then click "Slew to Object."

12.11 Show Scope Field

This command will center the MegaStar field at the current telescope position.

12.12 Tangent, Sky Commander, BBox and MicroGuider III.

These devices will use a readout window, which may be moved or resized.

The font size will change automatically as the window size is changed. You should first resize the vertical dimension until you have the desired text height. Then resize the window horizontally until the text fits in the window.

The contents of the readout window will depend on the **Digital Readout** option that was selected in the **Options** dialog box, described in Section 12.4 on page 107. The window can either display the telescope coordinates, or the offset to a target object.

12.13 Mel Bartels Telescope Control System

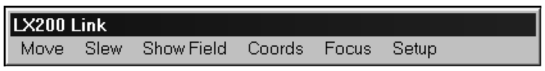
If you are not using the LX200 emulation supported by the Bartels system, you can "communicate" with the scope.exe program through the use of files. This is the method used when "Bartels" is selected in "Scope | Select Device." There will be no need to use the "Connect" command when interfacing in this manner.

When you execute the "Scope | Slew To Object" command, MegaStar will create the file **slew.dat** in the working directory. The current coordinates in MegaStar's Readout Bar will be written to this file, which will be read by scope.exe.

When you execute the "Scope | Show Scope Field" command, MegaStar will look for the file **slew_out.dat** in the working directory. This file is created by scope.exe, and contains the telescope coordinates.

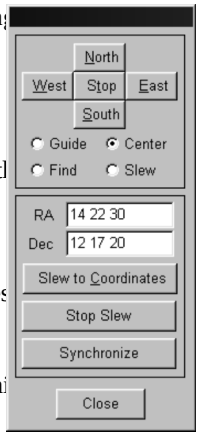
The web page www.bbastrodesigns.com/cot/operate_interfacing.html describes this interface.

12.14 LX200, AstroPhysics GTO and NexStar



When a connection is established to these telescopes, a floating window will be displayed. The only significant component of this window is its menu bar. The window can be moved and resized as desired, and will exist until the telescope link is terminated.
The menu bar shown above is for the LX200. The NexStar menu bar will only have the "Slew," "Show Field" and "Coords" menu items. But the descriptions given in the following sections will still apply.

12.14.1Move



Clicking the **Move** menu will display a dialog box containing control buttons. This dialog box will remain displayed until you click the **Close** button.

To move the telescope in one of the compass directions, first select the motion rate, if necessary (**Guide**, **Center**, **Find** or **Slew**). Then click on one of the direction buttons. To stop the motion, click on the same button again, or else click the "Stop" button. Performing the start/stop motion by clicking on the same button twice enables you to quickly stop the movement without needing to move the mouse to another button. This facilitates making small adjustments to the telescope position.

The other method of moving the telescope is to slew to specific coordinates. The RA and Dec that initially appear in the dialog box will be the coordinates in MegaStar's Readout Bar. Note that the Readout Bar coordinates are updated whenever the left mouse button is clicked within the boundary of the field display. They are also set whenever an object is centered using the "Locate" function. So to slew to NGC 4656, execute the Locate command for that object (or click on it if it is already in the field), then click "Slew to Coordinates" in the dialog box.

The **Synchronize** button only works with the LX200, and will refine the telescope alignment. Center field on an object that is in the LX200 database. Left click on that object in MegaStar and then click the Synchronize button. Note that the LX200 will synchronize on the object's coordinates from its internal database, not the coordinates from MegaStar.

12.14.2Slew

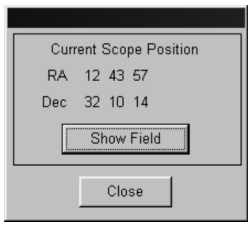
Clicking **Slew** in the menu will slew the telescope to the coordinates currently displayed in MegaStar's Readout Bar.

12.14.3Show Field

This will re-center the MegaStar field to match the current telescope position.

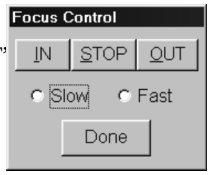
12.14.4Coords

The **Coords** menu displays a dialog box showing the current RA and Dec of the telescope. The **Show Field** button will re-center the MegaStar field to match the current telescope position. This button performs the same function as the "Show Field" menu command described in the previous section.



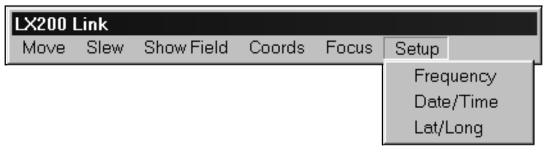
12.14.5Focus Control

This will display a dialog box containing focus control buttons. Select the focus speed, and then click on the "IN" or "OUT" button. To stop the motion, click on the same button again, or else click on the "STOP" button.



12.14.6Setup

Setup is a popup menu with three submenu items for setting the frequency, date/time and lat/long of the telescope.

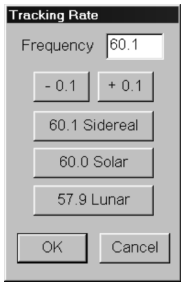


Frequency

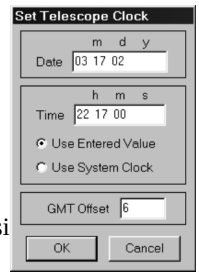
This function is only available for the LX200. The current value of the tracking frequency is displayed at the top of the dialog box.

You can change the value in the text box in three ways: Typing a value in directly, or clicking on the +/− 0.1 increment buttons, or by clicking on one of the preset value buttons. To initiate the frequency change in the LX200, choose "OK".

The valid range for the frequency is 56.4 to 60.1 Hz.



Date/Time

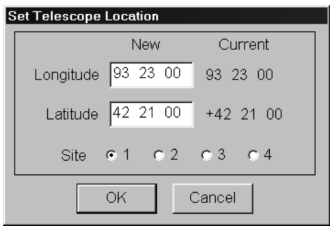


The dialog is initialized with the current telescope values. Modify the values as needed, then choose "OK" to update the telescope.

Note that there are two choices for setting the time. If **Use System Clock** is selected, the current PC clock time will be sent to the telescope when "OK" is chosen. If **Use Entered Value** is selected, then the time that appears in the text box will be sent.

Whenever the LX200 date is changed, the planetary positions are updated. As you probably know, this can take several seconds to complete (up to 20 or more). The cursor will change to an "hourglass" during this process.

Lat/Long



For the GTO, only the latitude and longitude values are used. The "Site" information is used for the LX200 only.

When this dialog box is opened, MegaStar sets the currently selected site in the LX200 to be the same as the site number selected in the dialog box. This will ensure that the telescope setting matches the dialog information. It would, of course, be better to simply read this data from the LX200 and display it. But according to the Meade documentation, there is no way to query the LX200 to determine the currently selected site.

Each time you select a site number by clicking on one of the radio buttons, that site will be made the currently selected site in the LX200, and the coordinates for that site will be displayed in the dialog box.

Choosing "OK" will send the latitude and longitude values in the text boxes to the telescope.

Whatever site is currently selected when the dialog box is exited (even if you exit using "Cancel"), that will be the site used by the LX200. That will also be the site used to initialize the dialog box (and the LX200) the next time this function is invoked.

Chapter 13. Data Boxes

When you click on an object in MegaStar using the left mouse button, a data box will be displayed. The information contained in the data box will vary depending upon the object type. But every data box will display the RA, Dec, object type, altitude, azimuth, rise time, set time and transit time of the object. For stars and DSOs, these values will be based on the current reference date and time of MegaStar. For solar system objects, they are based on the time for which the object's position was computed.

If you place the cursor over a data box and press the right mouse button, a context menu will appear. The options in the context menu will depend on the object type. The only option common to every context menu is "Copy," which will copy the contents of the data box to the clipboard.

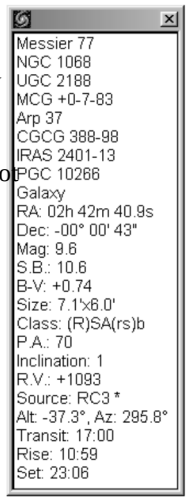
13.1 DSOs

The information given in a DSO data box will depend on the object type. For all types, a source will be given, which will be one of the following:

Archinal (Brent A. Archinal)
H-B93 (*Revised and Updated Catalog of Quasi-stellar Objects*, Hewitt & Burbidge, 1993)
JLynn (Jenni Lynn)
LEDA (Lyon-Meudon Extragalactic Database)
Lynds (*Catalogue of Dark Nebulae*, Lynds, 1965)
Lynga (*Catalogue of Open CLuster Data*, Lynga, 1987)
Mitchell (Larry Mitchell)
NED (NASA/IPAC Extragalactic Database)
NGC2000 (*NGC 2000.0*, Roger W. Sinnot, 1988)
PGC (*Catalogue of Principal Galaxies*, Paturel et al., 1989)
RC3 (*Third Reference Catalogue of Bright Galaxies*, de Vaucouleurs, et al., 1991.)
RCG (*Catalogue of Rich Clusters of Galaxies*, Abell et al., 1989)
Riddle (David Riddle)
Sharp 2 (*A Catalogue of HII Regions*, Sharpless, 1959)
Skiff (Brian A. Skiff)
Sky Cat (*Sky Catalogue 2000.0, Vol. 2*, Hirshfeld & Sinnott, 1985)
Str-ESO (*Strasbourg-ESO Catalogue of Galactic Planetary Nebulae*, Acker et al., 1992)
Strasbrg (*Strasbourg Catalogue of Galactic Planetary Nebulae*, Acker et al., 1980)

Note: An asterisk (*) next to the source indicates that one or more data items were modified from the original source (for example, a positional correction may have been made).

13.1.1 Galaxies



Mag—If known, the magnitude system will be shown in parentheses (B=blue, V=visual, P=photographic). Only galaxies from the RC3 will include this information. Most magnitudes from the PGC are in the B system, but there are also some V magnitudes. Since these are not flagged in the catalog, the system used for any given galaxy cannot be stated with certainty.

Note: MAC galaxy magnitudes are only rough estimates based on their appearance on RealSky images.

S.B.—Surface Brightness, in mag per square arcmin. Some of these are values taken directly from the RC3 catalog, and some are computed by MegaStar

B-V—Difference in magnitudes measured in the blue and visual wavelengths.

Size - Major Axis · Minor Axis. For RC3 galaxies, these values are the apparent isophotal dimensions at or reduced to a surface brightness of 25.0 B-mag per square arcsec.

Class—For RC3 galaxies, the revised Hubble classification system is used. For other galaxies, the old Hubble classification is provided. For many of the PGC galaxies, the classification consists of four codes:

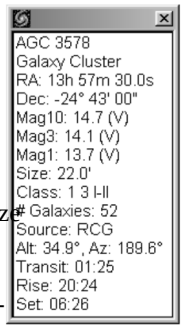
E for elliptical, L for lenticular, S for spiral, I for irregular.
B if a bar or semi-bar structure is present.
R if an inner or outer ring is present.
M for multiple or possibly interacting galaxies.

P.A. - Position angle in degrees, measured North to East. A p.a. of 0° indicates a North-South orientation. The p.a. range is 0° to 179°.

Inclination—Inclination to the line of sight, measured on a s cale from 1 (face-on) to 7 (edge-on)

R.V.—Radial velocity in km/sec.

13.1.2 Galaxy Clusters



Mag 10—Magnitude of the 10th brightest member.

Mag 3—Magnitude of the 3rd brightest member.

Mag 1—Magnitude of the brightest member.

Size—The new survey entries in the RCG (2713–4073) do not contain size values. The values which are given have been estimated based on the distance class of the cluster, using a table provided by Dr. Harold Corwin. The size values for entries 1–2712 are measured values.

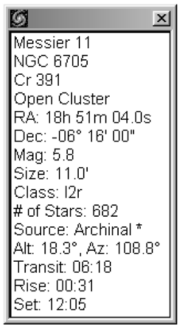
Class—There are three parts to the classification field: richness class, distance class and Bautz-Morgan classification (e.g., “1 4 III”).

A (:) indicates that a value is uncertain; a (?) means doubtful.

Distance Class	Magnitude of the 10th brightest galaxy
1	13.3 – 14.0
2	14.1 – 14.8
3	14.9 – 15.6
4	15.7 – 16.4
5	16.5 – 17.2
6	17.3 – 18.0
7	> 18.0
Richness Class	# of galaxies of mag 3 to mag 3 + 2
0	30 – 49
1	50 – 79
2	80 – 129
3	130 – 199
4	200 – 299
5	>300
Blautz-Morgan Class	Mag difference between 2 brightest galaxies
I	Large difference
II	Moderate difference
III	Little or no difference

 # Galaxies—Number of galaxies in the cluster.

13.1.3 Open Clusters



Class - Four-part Trumpler classification (e.g., “2 3 r n”)

Concentration

1 - Detached. Strong concentration toward center.
2 - Detached. Weak concentration toward center.
3 - Detached. No concentration toward center.
4 - Not well detached from surrounding star field.

Brightness Range

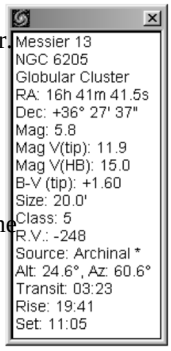
1 - Small range in brightness.
2 - Moderate range in brightness.
3 - Large range in brightness.

Richness

p - Poor (less than 50 stars).
m - Moderately rich (50–100 stars).
r - Rich (over 100 stars).

An “n” following the richness class indicates nebulosity involved.

13.1.4 Globular Clusters



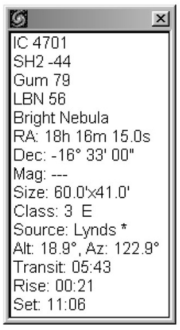
Mag V(tip)—Magnitude of the brightest stars in the cluster. This can predict the resolvability of the cluster, since you must be able to see at least a few individual stars in order to begin to resolve it.

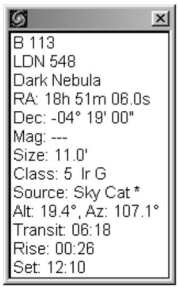
Mag V(HB)—Magnitude of the horizontal branch of the cluster's color-magnitude diagram (an observational version of the H-R diagram). This can also be predictive of the extent of resolvability, since these stars tend to be the brighter cluster stars.

Class—Shapley/Sawyer concentration class. Values range from 1 to 12. The smaller the number, the more concentrated the cluster.

R.V.—Radial Velocity in km/sec.

13.1.5 Bright Nebulae





Class—The number is Lynd's brightness class, on a scale of 1 (brightest) to 6 (faintest). The letter indicates whether it is an emission (E) or reflection (R) nebula, or a combination (E+R).

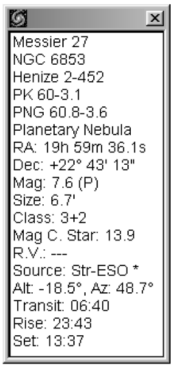
13.1.6 Dark Nebulae

Class—The number indicates opacity on a scale of 1 (least opaque) to 6 (most opaque).

The letter indicates the shape: Ir=irregular, E=elliptical, C=circular, Co=cometary, K=kidney, S=S-shaped

A "G" is appended if the nebula is or includes a globule.

13.1.7 Planetary Nebulae



Class—The Strasbourg Catalog does not include classification data, so this was added from *Sky Catalogue 2000.0* wherever possible. The Vorontsov-Velyaminov system is used:

1 = Stellar image

2 = Smooth disk a = brighter toward center
b = uniform brightness
c = traces of ring structure

3 = Irregular disk a = very irregular brightness distribution
b = traces of ring structure

4 = Ring Structure.

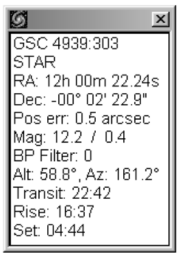
5 = Irregular form similar to diffuse nebula.

6 = Anomalous form.

These codes may be combined to describe more complex structures, e.g., "4+2".

Mag C. Star—Magnitude of the central star.

13.2 GSC Stars



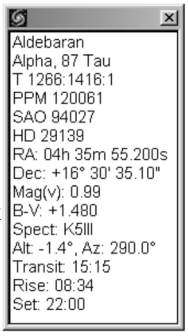
Pos err - Estimated positional error.

Mag - Magnitude, followed by the estimated magnitude error.

BP Filter - Passband filter of the magnitude measurement:

0 = IIIa-J / GG395	10 = IIa-D / GG495
1 = IIa-D / W12	11 = 103a-O / GG400
6 = IIa-D / GG495	18 = IIIa-J / GG385
8 = 103a-E / Red Plexiglass	

13.3 Tycho and Hipparcos Stars

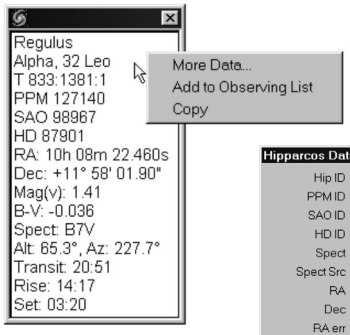


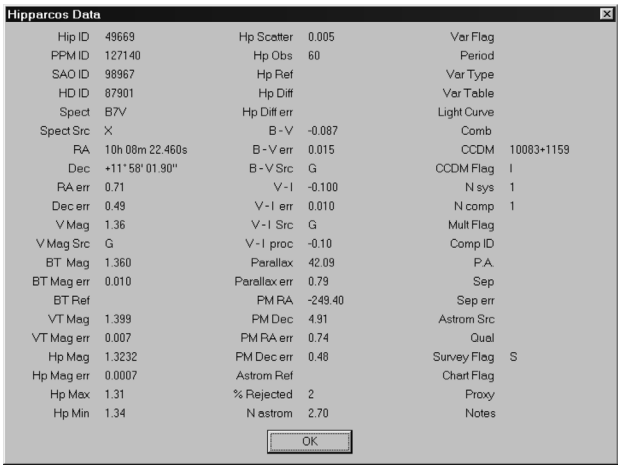
If applicable, the common name, Bayer letter and Flamsteed number of the star are given.

T indicates a Tycho designation, and HIP indicates an Hipparcos designation.

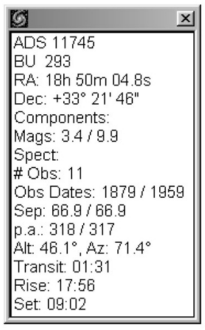
PPM, SAO and HD numbers are also given, if available.

For Tycho and Hipparcos stars only, the context menu will have a "More Data" option. If selected, a dialog box containing more information will be displayed.





13.4 Double Stars



Components—Components in the Lick IDS scheme, when the object has more than two.

Mags—Magnitudes of the primary and companion.

Spect—Spectral types of the components.

 # Obs—Number of observations (measurements).

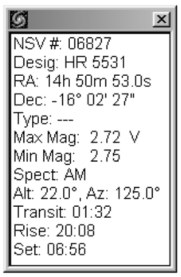
Obs Dates—Dates of the first and last observations used in the catalog.

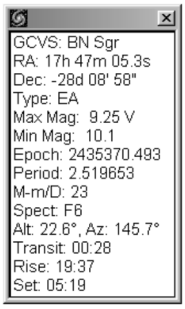
Sep—Separation in arc-seconds for the first and last observation.

p.a.—Position angles for the first and last observations.

Please refer to the file "wds.txt" in the docs folder of the CD-ROM for further information about the data contained in the *Washington Catalog of Double Stars*.

13.5 GCVS *and* NSV Variable Stars



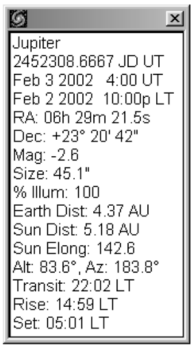


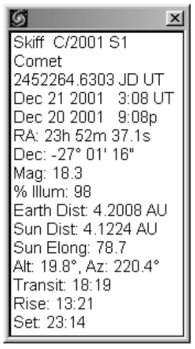
Refer to the file "gcvs.txt" for documentation on the data contained in the *General Catalogue of Variable Stars* (Kholopov, et al., 1988).

Refer to the file "nsv.txt" for documentation on the data contained in the *New Catalogue of Suspected Variable Stars* (Kukarkin, et al., 1982).

Both of these files are in the docs folder of the MegaStar CD-ROM.

13.6 Planets and Comets





The date and time for which the position was computed are given, in Julian Days (JD), Universal Time (UT) and Local Time (LT).

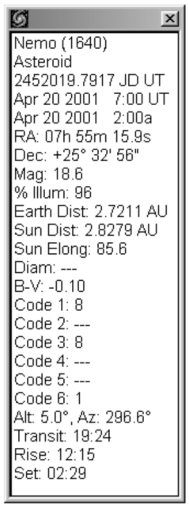
% Illum—Percent illumination of the body (i.e., the "phase").

Earth Dist—Distance from the Earth in Astronomical Units.

Sun Dist—Distance from the Sun in Astronomical Units.

Sun Elong—Elongation from the Sun in degrees.

13.7 Asteroids



This data is the same as that given for planets and comets, with the following additions:

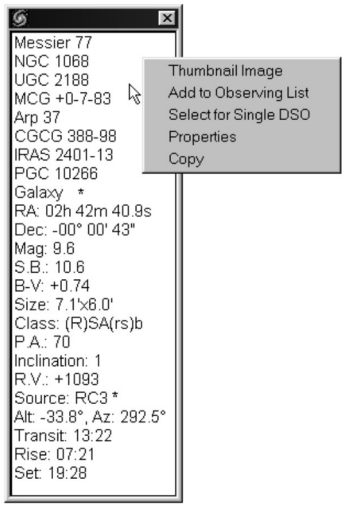
Diam—The diameter of the asteroid in km, if known.

Code 1 through **Code 6**—These are codes used in the Lowell asteroid data only (they do not apply to th MPC data). Refer to the file "astrddoc.txt" in the docs folder of the MegaStar CD-ROM for an explanation of these codes.

13.8 Context Menus

When you place the mouse cursor over a data box and press the right mouse button, a context menu will appear. The contents of this menu will vary with object type.

For DSOs, you will see the following menu:



If an image is available for the object, you can click **Thumbnail Image** to display it. An asterisk next to the object type indicates that it has an image. *This menu option will be absent if no image is available.* The image will be displayed in the background of the MegaStar field, and will remain until you remove it or select another image. Refer to Section 9.12 on page 90 for more information on thumbnail images. **Note:** Thumbnail images will only be displayed if the field size is larger than 3 arc-minutes and smaller than 6 degrees. If the current field size is outside of this range, "Thumbnail Image" will not appear in the context menu, even if an image is available for that object.

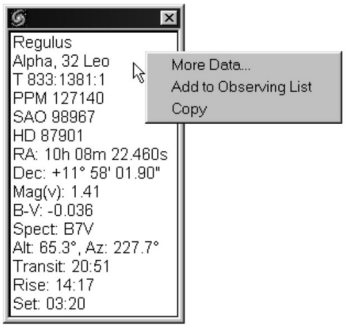
Add to Observing List will add that object to the currently active Observing List. Refer to Section 10.4 on page 94 for more information about this feature.

Select for Single DSO will make this object the "target object," explained in Section 6.1 on page 49.

Properties will display a dialog box for changing the display properties or group membership of the object. Refer to Section 6.1.2 on page 52.

Copy will copy the contents of the data box to the clipboard.

For Tycho and Hipparcos stars, you will see the following menu:



Clicking **More Data** will display a dialog box with additional information about the star.

Add to Observing List and **Copy** perform the same functions as those described for DSOs.

For solar system objects, only the "Copy" option will be available in the context menu. You cannot add planets, comets or asteroids to an Observing List.

For all other object types, the menu options will be "Add to Observing List" and "Copy."

Appendix A Constellation Names Pronunciations, Meanings and Abbreviations

Name	Pronunciation	Meaning	Possessive Form	Abbr.
Andromeda	An-DROM-eh-da	Princess Andromeda	Andromedae	And
Antlia	ANT-lee-ah	Air Pump	Antliae	Ant
Apus	AY-pus	Bird of Paradise	Apodis	Aps
Aquarius	AK-WARE-ee-us	Water Carrier	Aquarii	Aqr
Aquila	AK-will-ah	Eagle	Aquilae	Aql
Ara	A-ra, AY-rah	Altar	Arae	Ara
Aries	AY-ri-eez	Ram	Arietis	Ari
Auriga	Aw-RYE-ga	Charioteer	Aurigae	Aur
Boötes	Bo-OH-teez	Herdsman	Bootis	Boo
Caelum	SEE-lum	Graving Tool	Caeli	Cae
Camelopardalis	Ka-MEL-oh-pard-al-iss	Giraffe	Camelopardalis	Cam
Cancer	KAN-ser	Crab	Cancri	Cnc
Canes Venatici	KAY-neez Ve-NAT-i-sy	Hunting Dogs	Canum Venaticorum	CVn
Canis Major	KAY-nis MAY-jer	Large Dog	Canis Majoris	CMa
Canis Minor	KAY-nis MY-ner	Small Dog	Canis Minoris	CMi
Capricornus	KAP-ri-kor-nus	Sea Goat	Capricorni	Cap
Carina	Ka-RYE-na, Ka-REE-na	Ship's Keel	Carinae	Car
Cassiopeia	Kass-ee-oh-PEE-ah	Queen Cassiopeia	Cassiopeiae	Cas
Centaurus	Sen-TORE-us	Centaur	Centauri	Cen
Cepheus	SEE-fuse, SEE-fuss	King Cepheus	Cephei	Cep
Cetus	SEE-tus	Sea Monster	Ceti	Cet
Chamaeleon	Ka-MEE-leon	Chameleon	Chamaeleontis	Cha
Circinus	CIR-si-nus	Drawing Compasses	Circini	Cir
Columba	Kol-LUM-ba	Dove	Columbae	Col
Coma Berenices	KO-ma Beren-EYE-seez	Berenice's Hair	Comae Bernenices	Com
Corona Australis	Kor-OH-na Os-TRAL-iss	Southern Crown	Coronae Australis	CrA
Corona Borealis	Kor-OH-na Bor-ee-AL-iss	Northern Crown	Coronae Borealis	CrB
Corvus	KOR-vus	Crow	Corvi	Crv
Crater	KRAY-ter	Cup	Crateris	Crt
Crux	Krucks	Southern Cross	Crucis	Cru
Cygnus	SIG-nus	Swan	Cygni	Cyg
Delphinus	Del-FY-nus	Dolphin	Delphini	Del
Dorado	Do-RAH-do	Swordfish	Doradus	Dor
Draco	DRAY-ko	Dragon	Draconis	Dra
Equuleus	Ee-KWOO-lee-us	Colt	Equulei	Equ
Eridanus	Eh-RID-an-us	River	Eridani	Eri
Fornax	FOR-naks	Furnace	Fornacis	For
Gemini	JEM-in-eye	Twins	Geminorum	Gem
Grus	Grus	Crane	Gruis	Gru
Hercules	HER-cue-leez	Strong Man Hercules	Herculis	Her
Horologium	Hor-oh-LOW-jee-um	Clock	Horologii	Hor
Hydra	HIGH-dra	Female Water Serpent	Hydrae	Hya
Hydrus	HIGH-drus	Male Water Serpent	Hydri	Hyi
Indus	IN-dus	American Indian	Indi	Ind
Lacerta	La-SIR-ta	Lizard	Lacertae	Lac
Leo	LEE-oh	Lion	Leonis	Leo
Leo Minor	LEE-oh-MY-ner	Small Lion	Leonis Minoris	LMi
Lepus	LEE-pus	Hare	Leporis	Lep
Libra	LIE-bra, LEE-bra	Scales	Librae	Lib
Lupus	LEW-puss	Wolf	Lupi	Lup

Name	Pronunciation	Meaning	Possessive Form	Abbr.
Lynx	Links	Lynx (Bobcat)	Lyncis	Lyn
Lyra	LIE-ra	Lyre	Lyrae	Lyr
Mensa	MEN-sa	Table Mountain	Mensae	Men
Microscopium	Micro-SCOPE-ee-um	Microscope	Microscopii	Mic
Monoceros	Mo-NOS-eros	Unicorn	Monocerotis	Mon
Musca	MUS-ka	Fly	Muscae	Mus
Norma	NOR-ma	Carpenter's Square	Normae	Nor
Octans	OK-tans	Octant	Octantis	Oct
Ophiuchus	Oh-fee-YOU-kus	Serpent Bearer	Ophiuchi	Oph
Orion	Oh-RYE-an	Hunter Orion	Orionis	Ori
Pavo	PAY-vo	Peacock	Pavonis	Pav
Pegasus	PEG-a-sus	Flying Horse Pegasus	Pegasi	Peg
Perseus	PUR-see-us	Hero Perseus	Persei	Per
Phoenix	FEE-nicks	Phoenix	Phoenicis	Phe
Pictor	PICK-tor	Painter's Easel	Pictoris	Pic
Pisces	PIE-seez, PIS-eez	Fishes	Piscium	Psc
Piscis Austrinus	PIE-sis Os-TRY-nus	Southern Fish	Piscis Austrini	PsA
Puppis	PUP-is	Ship's Stern	Puppis	Pup
Pyxis	PIK-sis	Mariner's Compass	Pyxidis	Pyx
Reticulum	Re-TICK-you-lum	Reticle	Recticuli	Ret
Sagitta	Sa-JIH-ta	Arrow	Sagittae	Sge
Sagittarius	Sa-jih-TARE-ee-us	Archer	Sagittarii	Sgr
Scorpius	SCORE-pee-us	Scorpion	Scorpii	Sco
Sculptor	SKULP-tor	Sculptor's Apparatus	Sculptoris	Scl
Scutum	SKYOO-tum	Shield	Scuti	Sct
Serpens (Caput, Cauda)	SIR-pens (Ka-put, KAY-uda)	Serpent (Head, Tail)	Serpentis	Ser
Sextans	SEX-tans	Sextant	Sextantis	Sex
Taurus	TORE-us	Bull	Tauri	Tau
Telescopium	Te-le-SCOPE-ee-um	Telescope	Telescopii	Tel
Triangulum	Tri-ANG-you-lum	Triangle	Trianguli	Tri
Triangulum Australe	Tri-ANG-you-lum Os-TRAY-lee	Southern Triangle	Trianguli Australis	TrA
Tucana	Too-KAN-ah	Toucan	Tucanae	Tuc
Ursa Major	ER-sa MAY-jer	Great Bear	Ursae Majoris	UMa
Ursa Minor	ER-sa MY-ner	Small Bear	Ursae Minoris	UMi
Vela	VEE-la	Ship’s Sails	Velorum	Vel
Virgo	VER-go	Virgin	Virginis	Vir
Volans	VO-lanz	Flying Fish	Volantis	Vol
Vulpecula	Vul-PECK-you-la	Fox	Vulpeculae	Vul

Appendix B Catalog Descriptions

To locate objects by designation, you must enter the catalog designations exactly as they appear on this list (although you may use either upper or lower case). In some cases, there may be two acceptable options, separated by a comma.

The items in parentheses are informational only, and not valid for specifying catalog designations.

? (Unknown)

3CR (Quasars)
3C "
4C "
1SZ (Zwicky compact galaxies)
1ZW
2SZ
2ZW
3ZW
4ZW
5ZW
6ZW
7ZW
8ZW

A
ABELL (Abell planetaries)
ACH
AGC (Abell Galaxy Clusters)
AGCS (Abell Southern Supplement)
AM (Arp/Madore)
AND (I, II, III, IV)
ANON (Anonymous)
ANTALOVA, ANT
ARAK (Arakelian)
ARCHINAL
AUNER
ARP
ARPGC (Arp Globulars)

BARKHATOVA, BARK
BARNARD, B
BASEL
BERGERON, BERG
BERK (Berkely)
BF (QSOs)
BIURAKAN, BIUR
BLANCO
BOCHUM
BOL
BOL D
BRHT
BRUCK
[BS95]

C
CANNON
[CCS85]
CED (Cederblad)
CGCG
CL (QSOs)
CR (Collinder)
CSO (QSOs)
CT (QSOs)
CZERNIK, CZ

DDO (David Dunlop Obs.)
DJORG (Djorgovski)
DO (Dolidze)
DODZ (Dolidze/Dzimselejsvili)

E
ESO

FAIR (Fairall)
FORNAX
FRENCH
FROLOV

G
GRAHAM
GUM

[H60B]
[H86]
[H88]
HAFFNER
HARO
HARVARD

HENIZE, HE
HENIZEN
HICKSON, HICK (Galaxy Groups)
HOAG
HOGG
HP (Haute Provence)
[HS66]
HUBBLE
HW

IC
IRAS

JONCKHEERE, J
JONES

KARA (Karachentseva)
KAZ (Kazaryan UV excess)
KEMBLE
KING
KMHK
KOHOUTEK, K
KP (QSOs)
KRON
KUG (Kiso UV excess galaxies)

[L61]
LB (QSOs)
LBN (Lynds Bright Nebula)
LDN (Lynds Dark Nebula)
LEO (I, II)
LH
LILLER
LIND
LODEN
LONGMORE, LONG
LW
LYNGA

MAC (Mitchell Anonymous Cat.)
MAFFEI (I, II)
MARKARIAN, MKN
MAYER
MCG
MEL (Melotte)
MENZEL
MERRILL
MESSIER, M
MINKOWSKI, MINK

NASSAU
NBOL
NGC, N

OHSC

PAL (Palomar Globulars)
PB (Peimbert/Batiz)
PC (Peimbert/Costerro)
PEASE
PEREK
PGC (Principal Galaxies Catalog)
PHL (QSOs)
PISMIS
PK (Perek/Kohoutek)
PNG (Strasbourg-ESO planetary)
POX (Knuth emission-line objects)
[PWM78]

Q (QSO)

RCW (Rodgers/Campbell/Whiteoak)
ROSLUND
RU (Ruprecht)

[S73]
SANDULEAK, SA
SBS (Second Biurakan Survey)
SH2 (Sharpless Bright Nebula)
SHANE
SHAPLEY
SHER
SL (Sandqvist & Lindroos)
[SSWZ94]
STEPH (Stephenson)
STOCK

TERZAN, TER
THE (P. S. The)
TOL (Tololo galaxies)
TOMBAUGH, TOM
TON (Tonantzintla)
TR (Trumpler)

UGC (Uppsala Galaxy Catalog)

UGCA (Selected non-UGC galaxies)
UKS (United Kingdom Schmidt)
UM (University of Michigan)
UPGREN
US (QSOs)

VANDERVORT, VAND
VCC (Virgo Cluster Catalog)
VDB (van den Bergh bright nebula)
VDB-HA (van den Bergh/Hagen)
VDBERGH (VDB open clusters)
VV (Voronstov/Velyaminov)
VYSSOTSKY

WEIN
WESTERLAND
[WG71]
WRAY

X (X-Ray)

Appendix C Toolbar Manipulation

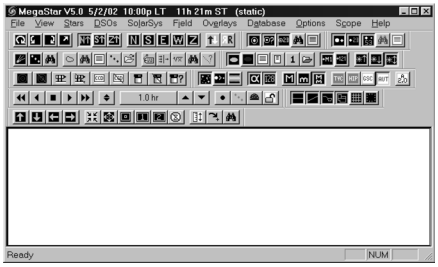
D.1 Manipulating docked toolbars

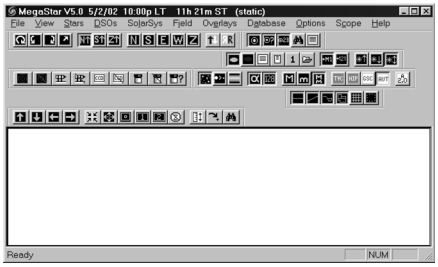
When you run MegaStar for the first time, all of the available toolbars will be displayed, and they will all be in their “docked” positions. Docked toolbars are attached to the MegaStar window, just below the main menu.

To remove any toolbars that you do not want, click the “View | Select Toolbars” menu. Uncheck any toolbars that you do not want to display and click the “OK” button. The MegaStar window will be refreshed to reflect the new toolbar selections. However, the arrangement of the toolbars will not be changed, so that there will be gaps where any removed toolbars used to be.

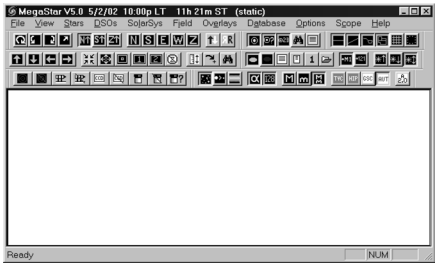
You can rearrange the toolbars to consolidate them and minimize the window area that they consume. To move a toolbar, click the left mouse button in the toolbar’s border area, and continue to hold down on the button. You can now drag the toolbar to a new location. It will be redrawn at the spot where you release the mouse button. If that position overlaps an existing toolbar, it will be shifted over to make room for the new one.

Whenever you change the toolbars selections with the Select Toolbars dialog box, you will probably need to rearrange them again. Windows does not always set the placement of toolbars in the most efficient manner when toolbars are added or removed.



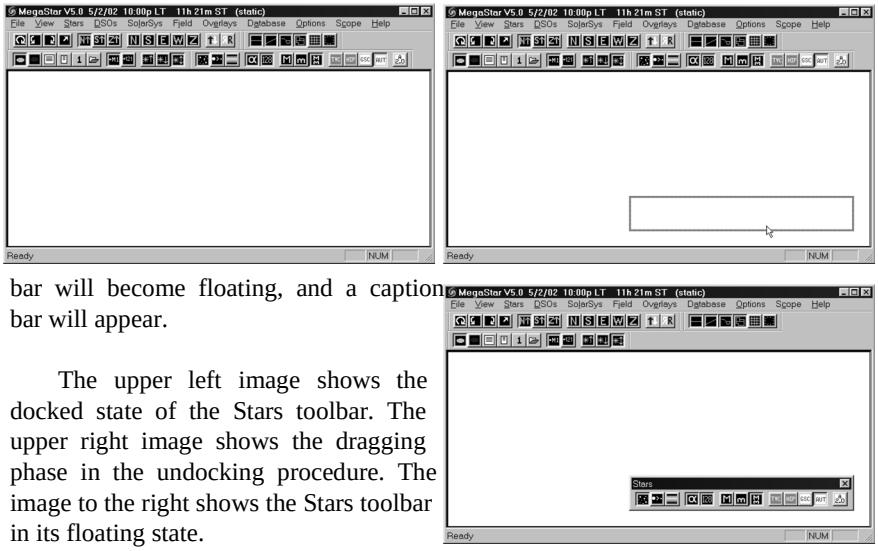


The upper left image shows a typical window with all of the toolbars displayed. The upper right image show the result when some of the toolbars are removed using the Select Toolbar dialog box. The image to the right shows the window after the toolbars have been moved to consolidate space.



D.2 Manipulating floating toolbars

Floating toolbars have their own little window with a caption bar, and they can be dragged to any location on the screen. To change a toolbar from its docked state to a floating state, click the left mouse button in the toolbar's border area, and continue to hold down on the button. Then drag the toolbar away from the docking area. If you release the mouse button when it is sufficiently away from the docking area, the tool-



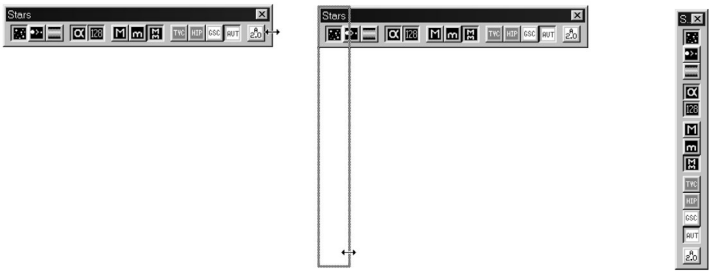
bar will become floating, and a caption bar will appear.

The upper left image shows the docked state of the Stars toolbar. The upper right image shows the dragging phase in the undocking procedure. The image to the right shows the Stars toolbar in its floating state.

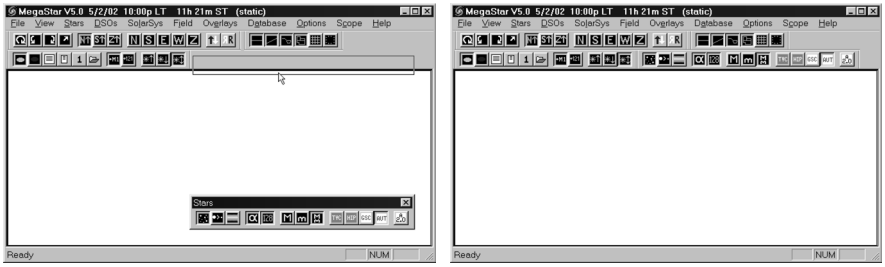
The caption bar of a floating toolbar will contain a description and a "close" button ("X"). Just as with any other window, you can click the close button in the caption bar to remove the toolbar. This is not recommended, however. MegaStar cannot detect that a toolbar has been removed using this method. Therefore, if you open the Select Toolbars dialog box, it will not accurately reflect which toolbars are actually currently displayed. It is preferable to always use the Select Toolbars dialog box to remove unwanted toolbars.

You also change the shape of floating toolbars. If you place the mouse cursor at the very edge of a toolbar window, the cursor will change into a double arrow. By pressing and holding down on the left mouse button, you can drag the edge of the toolbar window to change its shape. An outline of the new window will be drawn to indicate what the new shape will be. When you see the desired shape, release the mouse button and the toolbar will be redrawn.

Here is another example of changing the shape of a toolbar.



If you want to return a floating toolbar to its docked state, drag it to a location below MegaStar's main menu. The outline of the toolbar will be visible as you drag it. Release the mouse button to place it in the docked position.



Appendix D. Default Hot Keys

The functions are listed in the same order as they appear in the “Set Hot Keys” dialog box. To make finding a particular function easier, related functions are grouped together, and.the groups generally follow the order of MegaStar’s main menu system.

Hot Key Description	**Key Stroke +**	**Key Stroke**
Animation Object Lock on/off	Control	Insert
Animation Options Dialog		/
Animation Time, Decrease Step	Shift	Page Down
Animation Time, Increase Step	Shift	Page Up
Animation Trails on/off	Alt	Insert
Animation, Reset Start Time	Control	Home
Animation, Run Backward	Shift	,
Animation, Run Forward	Shift	.
Animation, Step Backward		,
Animation, Step Forward		.
Animation, Stop		End
Asteroid Elements, Add	Alt	[
Asteroid Elements, Modify	Alt	]
Asteroid Poistions, Compute	Control	F6
Asteroid Track, Create		F8
Asteroid, List/Locate		F6
Asteroid, Locate	Alt	F6
Asteroids on/off	Shift	F6
Bar Options Dialog, Readout		;
CCD Frame		D
CCD Frame, Clear	Control	D
Center Coordinates, Set		C
Center Marker on/off		T
Chart Mode on/off		7
Clipboard Options Dialog	Shift	C
Clipboard, Copy to	Control	C
Comet Elements, Add		[
Comet Elements, Modify		]
Comet Positions, Compute	Control	F5
Comet Track, Create		F7
Comet, Locate		F5
Comet/Asteroid Track, Find		F9
Comets on/off	Shift	F5
Command Window on/off	Control	W
Constell Boundaries on/off	Alt	F10
Constellation Labels on/off	Control	F10

Hot Key Description	Key Stroke +	Key Stroke
Constellation Lines on/off		F10
Date/Time Dialog	Shift	T
Double Chart Setup, Add To	Alt	2
Double Stars Dialog	Shift	Q
DSO Catalog Filter Dialog	Control	J
DSO Common Names Dialog	Control	L
DSO Database Dialog	Shift	D
DSO Database Utility	Control	K
DSO ID Labels on/off		A
DSO Labels Dialog	Shift	A
DSO Legend on/off		F3
DSO Mag Filter Auto, Set	Alt	N
DSO Mag Filter Dialog		Q
DSO Mag Filter Down	Shift	-
DSO Mag Filter Up	Shift	=
DSO Mag Labels on/off		K
DSO Types Selection Dialog		V
DSOs in Field, List		F4
DSOs, All, on/off		Delete
DSOs, Auxiliary, on/off	Control	A
DSOs, MAC, on/off	Control	M
DSOs, Primary, on/off	Control	P
DSS FITS Image, Display	Control	F
Ecliptic Line on/off	Alt	F11
Eyepiece Circle		E
Eyepiece Circles, Clear	Control	E
Face East	Shift	E
Face North	Shift	N
Face South	Shift	S
Face West	Shift	W
Field CCW, Rotate		PageDown
Field CW, Rotate		Page Up
Field Size 1, Go To		Space
Field Size 2, Go To	Alt	Space
Field Size, Previous	Control	Space
Field Size, Set		F
Field, Invert		I
Field, Mirror		J
Finder Circle	Shift	2
Finder Circle, Clear	Control	2
Font Options Dialog	Alt	Home
GCVS Catalog on/off	Shift	F3

Hot Key Description	Key Stroke +	Key Stroke
Grid Labels on/off	Alt	G
Grid on/off		G
Grid Options Dialog	Shift	G
GSC Catalog, Use	Shift	8
GSC Data to File		Insert
GSC Nonstars, Color		N
GSC Options Dialog	Shift	F4
Hipparcos Catalog, Use	Alt	8
Horizon Line on/off	Control	F11
Image Adjustment Dialog	Control	I
Image Brightness, Decrease		Num Pad 1
Image Brightness, Increase		Num Pad 2
Image Brightness, Use Default		Num Pad 0
Image Contrast, Decrease		Num Pad 4
Image Contrast, Increase		Num Pad 5
Image, Clear	Alt	Delete
Last Zoom, Undo	Control	Z
Look Up	Shift	U
Mooz (Zoom Out)		M
Night Vision Mode on/off	Alt	V
North Up, Set	Control	N
NSV Catalog on/off	Alt	F3
Object, Locate		L
Observing List Mode on/off	Control	O
Observing List, Create New		\
Observing List, Select An	Alt	\
Observing List, Show Current	Control	\
Orientation Dialog	Shift	O
Pan Down		Down Arrow
Pan Left		Left Arrow
Pan Right		Right Arrow
Pan Up		Up Arrow
Print Full-Page Chart		P
Print Options Dialog	Shift	P
Print, Double Chart		2
Print, Quad Chart		4
Quad Chart Setup, Add To	Alt	4
RealSky Options Dialog	Shift	R
RealSky, Display	Control	R
Rotation Tool, Show/Hide	Alt	Page Up
Scope Field, Show	Alt	F12
Scope Options Dialog	Shift	M

Hot Key Description	Key Stroke +	Key Stroke
Scope, Slew		F12
Scope, Sync	Control	F12
Show Alternate Plates on/off	Alt	P
SolarSys Filters Dialog	Alt	6
SolarSys Labels Dialog	Shift	6
SolarSys Labels on/off	Control	6
SolarSys Locate Object Dialog		6
SolarSys Select/Compute Dialog		5
SolarSys Tracks on/off	Alt	F7
South up, Set	Control	S
Star Catalog Auto, Set		8
Star Catalog Dialog	Shift	9
Star Colors on/off	Shift	F
Star Common Names Dialog	Shift	L
Star ID Labels on/off		B
Star Labels Dialog	Shift	B
Star Legend on/off		F2
Star Mag Filter Dialog		O
Star Mag Labels on/off		W
Star Magnitude Filter Auto	Control	U
Star Magnitude Filter Down	Alt	-
Star Magnitude Filter Up	Alt	=
Stars on/off		R
Stars, Shrink/UnShrink		S
Stars, Variable Dialog	Shift	V
Symbol Options Dialog		Home
Target Object Mode on/off	Control	T
Telrad Circles		3
Telrad Circles,Clear	Control	3
Toolbars on/off	Alt	F2
Tycho Catalog, Use	Control	8
USNO A2.0 Stars on/off		U
Variable Star Labels on/off	Control	F3
Variable Stars, List	Control	F2
View, Save or Restore a	Control	V
WDS Double Star Catalog on/off	Alt	F8
WDS ID Labels on/off	Control	F8
WDS Separation Labels on/off	Shift	F8
WDS, List	Control	F9
WDS, Locate	Alt	F9
Zenith up, Set	Alt	Z
Zoom In		Z

In accordance with an agreement between E.L.B. Software and The Association of Universities for Research in Astronomy, Inc., the following is a reproduction of the booklet which accompanies the *Guide Star Catalog* Version1.1 CD-ROM.

The Guide Star Catalog

VERSION 1.1

An all-sky astrometric and photometric
catalog to support the operation of the
Hubble Space Telescope

This set of two CD-ROMs in the ISO 9660 format contains the Guide Star Catalog - Version 1.1, with an issue date of 1 August 1992.

The Guide Star Catalog (GSC) was prepared by the Space Telescope Science Institute (ST ScI), 3700 San Martin Drive, Baltimore, MD 21218, USA. ST ScI is operated by the Association of Universities for Research in Astronomy, Inc. (AURA), under contract with the National Aeronautics and Space Administration (NASA).

1. INTRODUCTION

The Guide Star Catalog (GSC), which has been constructed to support the operational need of the Hubble Space Telescope (HST) for off-axis guide stars, contains nearly 19 million objects brighter than sixteenth magnitude, of which more than 15 million are classified as stars.

The original version of this catalog, GSC 1.0, is described in a series of papers: Lasker et al. (1990); Russell et al. (1990); and Jenkner et al. (1990); hereafter referred to as Papers I, II, and III. Additions and corrections made in GSC 1.1 address

- incompleteness, misnomers, artifacts, and other errors due to the overexposure of the brighter stars on the Schmidt plates,
- the identification of blends likely to have been incorrectly resolved,
- the incorporation of errata reported by the user-community or identified by the analysis of HST operational problems.

Among the primary authors of the GSC 1.0 and the associated systems, the scientific responsibilities were divided as follows: Helmut Jenkner, system coordination and overall design; Barry M. Lasker, astrophysics and photometry; Brian J. McLean, algorithmic analysis and systems development; Jane L. Russell, astrometry; Michael M. Shara, system management; and Conrad R. Sturch, production management and quality control. GSC 1.1 analysis and production were performed primarily by Jesse B. Doggett, Daniel Egret, Brian J. McLean, and Conrad R. Sturch.

Helmut Jenkner is on assignment from the European Space Agency; Jane L. Russell is currently affiliated with the Applied Research Corporation, Landover, MD; and Conrad R. Sturch is with the Astronomy Programs, Computer Sciences Corporation at Space Telescope Science Institute. Daniel

Egret is affiliated with Observatoire de Strasbourg, France.

2. DISCUSSION OF THE GSC 1.0 PROJECT

Astronomical and Algorithmic Foundation

As described in Paper I, the GSC is primarily based on an all-sky, single epoch, single passband collection of Schmidt plates. For centers at +6 degrees and north, a 1982 epoch "Quick V" survey was obtained by the Palomar Observatory, while for southern fields, materials from the UK SERC J survey (epoch approximately 1975) and its equatorial extension (epoch approximately 1982) were used. In addition, over 100 short-exposure plates were taken with the Palomar Oschin and UK Schmidt telescopes to cover complex regions including the southern Milky Way, the Magellanic Clouds, and M31. These northern, southern, and supplemental plates hereafter are referred to as N, S, and X plates, respectively. The plates were digitized into 14,000-square rasters at 25 um sample intervals using modified PDS microdensitometers.

The sky-background was modeled with a bi-dimensional cubic spline approximation to the modal level. Then an object finder, based on locating connected pixels at a certain threshold above the background, was used to obtain, for each plate, a list of positions, sizes, intensities, and related descriptive parameters. Images with multiple peaks were deblended by an algorithm based on correlations against a library of stellar images.

The identified objects were classified as stars or non-stars by an interactive multivariate Bayesian classifier that used image features from the object-detection steps and was started from a small set of objects visually identified on each plate. Comparison of classifications from multiply cataloged objects in the plate overlap areas shows that the purity of objects classified as stars is typically 97 percent.

Photometric and Astrometric Calibrations

The GSC calibrations were obtained on a plate-by-plate basis by polynomial modeling against the photometric and astrometric reference catalogs.

Photometry is available in the natural systems defined by the individual plates in the GSC collection (generally J or V), and the calibrations are done using B, V standards from the Guide Star Photometric Catalog (Lasker, Sturch, et al., 1988).

In Paper II the overall quality of the photometry near the standard stars was estimated from the fits and other tests to be 0.15 mag (one sigma, averaged over all plates), while the quality far from the sequences was estimated from the all-sky plate-to-plate agreement and from comparisons with independent photometric surveys to be about 0.3 mag (one sigma), with about 10% of the errors being greater than 0.5 mag. Additionally, Ratnatunga's (1990) comparison of the GSC against totally independent J-band photographic photometry for three southern fields (20 sq deg area) for $12.5 < J < 15.5$ shows agreement at the 0.1 – 0.2 mag level.

Astrometry, at equinox J2000, is available at the epochs of the individual plates used in the GSC; and the reductions to the reference catalogs (AGK3, SAOC, or CPC, depending on the declination zone) use third order expansions of the modeled plate and telescope effects. The fits to the reference catalogs lie in the range 0.5" to 0.9", and most of this is attributable to errors in the reference catalogs, to centroiding errors on the relatively large images of the reference stars, and to unmodeled astrometric effects.

Paper II reported estimates of the overall external astrometric error, produced by comparisons of independently measured positions, in the range 0.2" to 0.8" (per coordinate), depending on the areas of the plate and the sky. Then from a more extensive analysis against the Carlsberg Automatic Meridian Circle data, Taff et al. (1990) found that GSC absolute positional errors from plate center to edge vary from 0.5" to 1.1" in the north and from 1.0" to 1.6" in the south, and that relative errors at half-degree separations range from 0.33" to 0.76" depending upon hemisphere and magnitude.

Production, Database Organization, and Population Statistics

Paper III describes the software system used to produce the GSC. It consisted of a set of (primarily non-interactive) image-processing and calibration programs interconnected by a set of pipeline files and supported by databases organized on a plate-by-plate basis. A set of utility programs was also provided to support quality control and to correct operational problems.

Object names are of the form GSC rrrrr nnnnn, where the first field specifies an internal region number and the second is an ordinal within it. For objects cataloged from more than one photographic plate, an entry was made from each image; and all entries for the same object were given the same unique name.

Paper III also reviews the database for compiling statistics of objects with multiple entries and the details of the organization and structure of the GSC, including the provisions for assigning unique names, for cataloging objects lying in the plate overlap regions, for rapidly indexing positions against regions, and for recovering the original plate measurements. The separate count statistics for stellar and non-stellar objects on a plate-by-plate basis are provided in the supporting tables.

User Interfaces, Utilities, and Astronomical Applications

The all-sky collection of Schmidt plates that were digitized, archived to optical disc, and processed to generate the Guide Star Catalog (GSC) constitute a general image resource for astronomical research.

This data set, combined with the computing environment provided by the Guide Star Astrometric Support Package (GASP), major elements of which are exported within the Space Telescope Science Data Analysis System, provides random access to a digital image in any part of the sky. The GASP environment also supports access to the GSC and to other major astronomical catalogs.

3. REVISIONS IN GSC 1.1

The GSC 1.1 activities performed to address a number of known problems in GSC 1.0 are summarized here and described in detail in the text file for this revision, REV_1_1.TBL;1.

Two concerns related to the brighter stars arise from the heavily overexposed images on the Schmidt plates used in the GSC, namely an incompleteness and a reduced precision. Both are addressed in the domain $V < 7.5$ by the use of data from the INCA Data Base (Turon et al., 1992; Jahreiss et al., 1992; Grenon et al., 1992) in the Tycho Input Catalog (TIC; Egret et al., 1992). Such entries are designated by the plate identifier +056 in GSC 1.1. The limit of $V < 7.5$ preserves the original GSC data for objects that were used in the GSC 1.0 astrometric calibration.

Naming errors occur when objects catalogued from more than one photographic plate have positional errors sufficiently large that crossmatching of the overlapping plate areas is done incorrectly. The most significant known instances of this in GSC 1.0 were associated with overexposed (and therefore badly centroided) images of the brighter stars. A search around the positions of the INCA stars facilitated the identification of these naming errors, which were then removed in GSC 1.1.

GSC 1.0 contains many pairs of objects (from single plates) with separations significantly smaller than the expected resolution of the catalog, which Garnavich (1991), based on a study of four northern plates, estimates at ~10" for $8.0 < V < 14.0$. Visual inspection shows that these are generally blends that have been properly resolved, but then affected by a centroider defect that made the separations artificially small. Such components of blends with incorrect separations are given a classification of 2 (blend; cf. the text file for a full listing of the codes).

For stars with $V < 8$, image-processing artifacts near the diffraction spikes exist in GSC 1.0. In GSC 1.1, potential artifacts were identified by use of a purely geometrical criterion (proximity of the object to the spike), and were assigned a classification of 5.

Small areas around southern stars brighter than V ~3 are not processed from the Schmidt plates and were left blank in GSC 1.0. For these, GSC 1.1 contains entries from supplemental astrograph plates taken with the GPO (Gran Prisma Objectif) telescope on La Silla, and the astrograph at the Black Birch Observatory (BBO) in Blenheim, New Zealand. Because of their smaller fields, the pho-

tometric and astrometric calibrations of data from most GPO and a few BBO plates were performed against nearby GSC entries based on the Schmidt plates.

A number of specific errors in GSC 1.0 have been identified by the user-community and by analyses of HST operational problems. These generally involve naming errors, plate flaws, misclassifications, and multiple stars; most are individually corrected in GSC 1.1. Also, the photometric error parameter in GSC 1.1 is now correctly described by equation (3) in Paper II; i.e., the erratum of footnote 5 therein is no longer pertinent. Plans for GSC maintenance beyond version 1.1 include an astrometric recalibration (cf. Taff, Lattanzi, and Bucciarelli, 1990), and investigation of erroneous double entries that may exist for V > 7.5.

4. ORGANIZATION OF THE DATA FILES

The Guide Star Catalog is subdivided into regions that are bounded by small circles of right ascension and great circles of declination, and that are numbered consecutively from 0001 to 9537. Data for each region are stored as separate files; these files are contained in directories, each of which subtends a 7.5 degree zone of declination. The Guide Star Catalog is distributed as a two CD-ROM set, divided at a declination of −7.5 degrees. An introductory file (README.TXT;1) and the supporting tables are duplicated on both discs.

All data files (i.e., with the exception of the file README.TXT;1 and the directory files) are in FITS (Flexible Image Transport System; Greisen et al., 1981; Wells et al., 1981; Grosbol et al., 1988; and Jahreiss et al., 1992) table format.

The root directory contains the following files:

`README.TXT; 1`	—Introduction
`GSC`	—Directory for GSC region files
`TABLES`	—Directory for GSC supporting tables

Directory GSC contains directories for the 7.5 degree zones in declination; these directories in turn contain the GSC region files in FITS format for the respective zone, with file identifiers of the form nnnn.GSC;1, where nnnn is the 4-digit decimal region number, with leading zeroes used as required to fill the field. The directories are named as follows:

Directory	Declination		Regions		Disc
	From	To	From	To	
N0000	+00º 00'	+07º 30'	0001	0593	1
N0730	+07º 30'	+15º 00'	0594	1177	1
N1500	+15º 00'	+22º 30'	1178	1728	1
N2230	+22º 30'	+30º 00'	1729	2258	1
N3000	+30º 00'	+37º 30'	2259	2780	1
N3730	+37º 30'	+45º 00'	2781	3245	1
N4500	+45º 00'	+52º 30'	3246	3651	1
N5230	+52º 30'	+60º 00'	3652	4013	1
N6000	+60º 00'	+67º 30'	4014	4293	1
N6730	+67º 30'	+75º 00'	4294	4491	1
N7500	+75º 00'	+82º 30'	4492	4614	1
N8230	+82º 30'	+90º 00'	4615	4662	1

S0000	-00º 00'	–07º 30'	4663	5259	2
S0730	-07º 30'	–15º 00'	5260	5837	2
S1500	-15º 00'	–22º 30'	5838	6411	2
S2230	-22º 30'	–30º 00'	6412	6988	2
S3000	-30º 00'	–37º 30'	6989	7522	2
S3730	-37º 30'	–45º 00'	7523	8021	2
S4500	-45º 00'	–52º 30'	8022	8463	2
S5230	-52º 30'	–60º 00'	8464	8839	2
S6000	-60º 00'	–67º 30'	8840	9133	2
S6730	-67º 30'	–75º 00'	9134	9345	2
S7500	-75º 00'	–82º 30'	9346	9489	2
S8230	-82º 30'	–90º 00'	9490	9537	2

Directory TABLES contains the following supporting files for the GSC, written in FITS table format:

`COMMENTS.TBL;1`	—Introduction and general comments.
`REV_1_1.TBL;1`	—Comments on GSC 1.1 revisions.
`PLATES.TBL;1`	—Information on the plates used in the GSC.
`PROCESS.TBL;1`	—Image processing parameters.
`ASTR_CAL.TBL;1`	—Parameters of astrometric calibrations.
`PHOT_CAL.TBL;1`	—Parameters of photometric calibrations.
`C_UP_POP.TBL;1`	—Catalog update population statistics.
`ST_POP.TBL;1`	—Population statistics for stars.
`NS_POP.TBL;1`	—Population statistics for non-stars.
`REGIONS.TBL;1`	—Boundaries of GSC regions.
`C_RE_POP.TBL;1`	—GSC region population statistics.
`LG_REG_X.TBL;1`	—Index to large regions.
`SM_REG_X.TBL;1`	—Index to small regions.
`XREF_P2R.TBL;1`	—Cross-reference table, plates to regions.
`XREF_R2P.TBL;1`	—Cross-reference table, regions to plates.

5. ACKNOWLEDGEMENTS

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- by contributing to the GSC 1.0 error discussion or by reporting specific errors in GSC 1.0:

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- or pre-mastering the CD-ROMs: Ian Evans;
- and by making essential contributions to the project's infrastructure: Marian Iannuzzi, Greg McLeskey, Dave Paradise, Don Stevens-Rayburn, and Patty Trovinger.

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