General User's Guide
to
CLEA Windows Software

Contents

I. Introduction

I-1. Purpose

This document provides general technical information for users of CLEA software modules for Windows. It includes discussions of hardware and operating system requirements (Section II); software installation and operation (Section III); files associated with the exercises (Section IV); and options and file formats for possible instructor modifications (Section V). New in this revision are information on the installation and operation of CLEA Windows software under Windows 95 (throughout Sections II and III), procedures for installing the software on a network drive (Section III), a description of the revised CLEA Help facility and associated files (Section V-3), a general description of the CLEA star field data files that are used in a number of the exercises (Section V-4), and a discussion of the use of spreadsheets with CLEA Windows software (Section V-5). Some of the original material has been revised in light of experiences with beta versions of the software, both our own and those reported to us.

The material in this guide is intended for use by the instructor and by other personnel involved in installing and configuring the exercise software and PC hardware. It is not intended for distribution to the students. (The word "user" when it appears herein should be interpreted as "instructor", and not "student".) Additional technical information specific to each exercise is provided in the Software User's Guide that accompanies each software module.

I-2. Acknowledgements

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II. System Requirements

II-1. Hardware

CLEA exercises for Windows require an IBM or compatible PC, running Microsoft Windows 3.0 or later (see Section II-2). Users should experience no difficulties running the software with processors Intel 80386 (or equivalent) and above (80486,Pentium), possessing a minimum of 4 MBytes of RAM. Although some versions of Windows will run on 80286 machines and on machines with 2 MBytes of RAM, user experiences have shown these configurations to be generally inadequate for the CLEA exercises. For optimum performance we recommend a fairly fast processor (33 MHz 486DX or above) with 8 MBytes or more of RAM, running Windows 3.1x (in 386 Extended mode) or Windows 95. On 386SX/DX and 486SX machines, a floating point coprocessor (Intel 80x87 or equivalent) is highly recommended, but is not required. (A Weitek coprocessor, if present, is not used.) A mouse is a definite requirement. A color display (VGA or better) is required; a high-speed video accelerator card is advantageous (see Section II-4).

II-2. Operating System

Current CLEA software modules for Windows are 16-bit Windows applications that will run under Microsoft Windows Versions 3.0 and later, including Versions 3.1, 3.1.1 (Windows for Workgroups), Windows 95, and Windows NT (Version 3.5). Some users report successfully running these exercises under OS/2, utilizing the WIN-OS2 facility. The CLEA software cannot be run as standalone programs under DOS.

II-3. Disk Space

A hard disk is required. Each exercise requires an average of 2 MByte of disk space. (Some require significantly more, up to as much as 5 MByte.) You can reduce the overall requirement somewhat by deleting unneeded bitmap (.BMP) and compressed distribution (.ZIP) files (see Section V-2), and by placing all the exercises in a single directory to eliminate redundancies (see Section III-1 for details, including some discussion of why this may not be the preferred technique).

II-4. Video Issues

Unfortunately, beyond the VGA base (640x480, 16 colors) there is very little standardization in video cards/drivers used to run Windows. Most newer cards (usually identified as S(uper)VGA) possess a minimum of 1 MByte of display memory and offer additional modes - resolutions to 1024x768 and beyond, with palettes including as many as 16 million colors. Many Windows users are probably unaware of how their system is configured or what mode they are using. We initially attempted to address the lowest common denominator (VGA - 640x480 pixels, 16 colors) in our development of these programs, but many of the available image files do not display well in 16 colors and so we have adopted a 256-color palette as our standard. We have further determined that employing one of the specially designed high performance video processor cards (usually identified as a graphics or Windows "accelerator") can significantly improve the overall performance (and sometimes appearance) of the CLEA software without requiring a CPU upgrade. Individual discussions of color palette, resolution, and changing the video software driver are presented in Sections II-4.1 through II-4.3.

II-4.1. Color Palette

As noted above, best results will be obtained with these exercises when Windows is configured with a graphics driver that uses 256 or more colors. The software is not designed for monochrome monitors, and will not, in general, give satisfactory results in monochrome.

If you are running Windows with a 16-color video card and/or palette, the software will detect this and access special 16-color bitmaps where required. The alternate 16-color logo and title screens furnished with all exercises have a noticeably different appearance, which is satisfactory but not nearly as eye-catching as the 256-color versions. More importantly, the grayscale limitations of the 16-color mode give an unsatisfactory appearance to extended objects like galaxies and nebulae, and make it impossible to adequately display spectra in grayscale. If your video card supports 256 (or more) colors, you may be able to change the Windows driver or settings to make use of the full color range (see Section II-4.3). The exercise software will then automatically use the 256-color versions of the bitmaps, and provide authentic grayscale displays of spectra and extended objects.

II-4.2. Resolution/Size

CLEA software for Windows is designed to display full-screen in a 640x480 pixel graphics mode. Higher resolution modes (800x600, 1024x768) may also be used; the display will appear smaller, but properly proportioned. This can be advantageous, as Help and other pop-up windows can be opened, re-sized if necessary, and re-positioned on the screen so that they can be referred to directly as the exercise proceeds. The process for changing the resolution is the same as that for changing the color palette, you must change the video driver or settings, following the steps outlined in Section II-4.3. One minor complication is that the fonts do not scale exactly between all graphics modes. This sometimes results in oversized labels on the control buttons, and truncated text lines with a horizontal scroll bar on the Help windows. If this occurs on your Help window, simply drag the right side of the window outward until the horizontal scroll bar disappears, and the text lines will be visible in their entirety.

II-4.3. Changing the Video Software Driver

If your computer is currently running Windows in a 16-color mode and you would like to improve the appearance of the displays, and/or you would like to try a different screen resolution, you may be able to change the Windows video driver (if your video card will support the mode you want). Begin by consulting your Windows documentation and installation procedure for information on installing/checking/changing the graphics driver. Also check the documentation and any software that came with your video card. A Windows driver (or drivers) may have been included, and the documentation may describe the installation procedure. The sections that follow outline the procedures for changing the video driver under Windows 3.n (Section II-4.3.1) and Windows 95 (Section II-4.3.2).

II-4.3.1 Changing the Video Driver Under Windows 3.n

The following is a general outline of the basic steps required to change the video driver in Windows 3.1. The procedures for related versions (3.0, 3.1.1) are similar, but some differences may be encountered.

1. Have on hand your Windows installation disks and any disks containing drivers and other software that came with your video card.
2. Start Windows. From the "**Main**" window select "**Windows Setup**".
3. Select "**Options**", then select "**Change System Settings**".
4. Select "**Display**". A list of drivers will appear, with your current driver highlighted. You should make a note of it so you can return to it later, if necessary. If a driver appropriate to your video card and desired mode appears on the list, select it. If you are installing a driver that came with your card and it does not appear on the list, select "Other".
5. Follow the directions that appear.You may want to perform the process several times to sample various modes. Once specific drivers have been loaded you can switch between them fairly rapidly using the above procedure; you do not need the Windows and drivers disks.

> One note of caution: This procedure is not without its hazards. For example, if you select and install a driver/mode that is not supported by your video card you may render Windows unusable. In this case you will need to run **SETUP** from DOS to restore your original driver. If you start Windows from your AUTOEXEC.BAT file you will probably have to boot DOS from drive A: to begin this process. Then change to the directory C:\WINDOWS and type **SETUP** at the prompt.

II-4.3.2 Changing the Video Driver Under Windows 95

The following steps outline the general procedure for changing video settings (color palette and resolution) under Windows 95:

1. Access the control panel. (Select "Start"->"Settings"->"Control Panel", or double-click the "My Computer" icon, then double-click the "Control Panel" icon..
2. Double-click the "Display" icon.
3. Select the "Settings" tab at the top of display.
4. Select the desired color palette from list.
5. Select the desired screen resolution by moving the slider bar labeled "Desktop Area". Note that the maximum resolution available changes with the color palette selected. You may want to check various combinations of color palette and resolution to determine the best settings.
6. Select the desired font size from list. We prefer small fonts for resolutions of 640x480 and 800x600, large fonts for 1024x768 and greater. You may not agree, so experiment.
7. When you have completed your selections, select "Ok". In most cases a Windows restart will be required - just follow any directions that appear.

The procedure above assumes that all appropriate drivers have already been installed. This probably occurred during the installation of Windows 95 itself or the installation/replacement of a video card. If you need to install new or additional drivers, you should have on hand the disk(s) containing the driver(s), and carefully read any documentation that came with the video card or driver software. Unless directed otherwise (specifically for Windows 95), proceed as follows:

1. Follow the steps above through Step 3.
2. Select "**Change Display Type**...".
3. Under "**Adapter Type**", select "**Change**...".
4. Follow the directions that appear.

III.   Installation and Operation

As noted in Section II-2, these exercises must be run under Microsoft Windows, Versions 3.0 and later. CLEA software is distributed in a packed form to conserve disk space and minimize download time; you must unpack it onto your hard disk before you can run it. After you have unpacked the software, there are several methods by which you can run it, depending on the version of Windows, and whether or not you choose to install it under Windows. Unpacking the distribution files is described in Section III-1; techniques for running the software and installing it under Windows are presented in Section III-2. Where necessary, separate instructions are provided for Windows 3.n and Windows 95.

> **NOTE:** Knowledgeable Windows users will realize that there are a number of ways to accomplish the tasks described in the sections that follow, especially under Windows 95, and some of the activities can also be performed successfully from the DOS prompt. We present one viable technique, with a Windows 95 alternative where required, to avoid a complex write-up and confused users.

III-1. Unpacking the Distribution Files

Required files for each exercise are compacted into a distribution file **CLEA_*XXX*.ZIP**. ("*XXX*" is used throughout this discussion in place of the three-letter identifier that denotes the exercise to which a file belongs. For example, the Jupiter Moons exercise is distributed in file CLEA_JUP.ZIP, which contains working files CLEA_JUP.EXE, README.JUP, etc.) A few of the exercises (CLEA_SPE, CLEA_LSS) require additional working files, which are also compacted into .ZIP files. (These additional compact files have no fixed naming convention.) All .ZIP files associated with a particular exercise must be unpacked into a working directory (on hard disk) before the exercise can be run.

> **NOTE:** If you received the exercise on a diskette from CLEA, you should have all the necessary .ZIP files. If you downloaded the software via the Internet, you should check for any associated README files. A text format copy of the exercise Users' Guide is included in every **CLEA_*XXX*.ZIP** file. Once you have unpacked the file you should check the Users' Guide to verify that you have all the files before attempting to run the exercise.

The working files for each exercise must be extracted from the .ZIP file using the PKUNZIP program (also included on the distribution diskette), and placed together in a single directory, such as C:*XXX*_LAB. All CLEA exercises may be placed in the same directory, as the names of exercise-specific files are unique to each. This will yield some savings in disk space, as multiple copies of the CLEA logo bitmap and a few other files will be eliminated. However, we recommend keeping each exercise in its own directory. This will clearly identify the files that belong to each exercise and help to avoid confusion, especially when installing future version updates.

III-1.1. Create a Directory or Folder

You must establish a directory (or folder) to hold the exercise software. If you are placing the exercise software in an existing directory on your hard disk you can proceed to Section III-1.2, otherwise follow one of the techniques below. (If you wish to install the software on a shared network drive, you should read Section III-3 before proceeding.)

III-1.1.1. Windows 3.n

To create a new directory under Windows 3.n:

1.   Access the File Manager. (If the file manager icon does not appear on your screen, you can usually access it from the **Main** program group..
2.   Select **File**->**Create Directory** from the File Manager menu.
3.   Fill in the name of the directory you want to create.

      Examples: C:\CLEA\HUB_LAB, C:\CLEA\JUP_LAB, etc.

III-1.1.2. Windows 95

To create a new folder under Windows 95:

1. Access the Windows Explorer. (Select **Start**->**Programs**->**Windows Explorer**.)
2. Double click on the C: drive icon. From the Explorer menu, Select **File**->**New**->**Folder.** Name the folder and press enter. For example, the folder which will contain each of the CLEA exercises is named CLEA.
3. Locate and select the folder where you want to place the CLEA software. Select **File**->**New**->**Folder** from the Explorer menu.
4. The new folder will appear. Type in a name and press the Enter key. Enter a valid (unqualified) DOS directory name, for example, **JUP_LAB**. PKUNZIP will not correctly handle a folder name like **Jupiter Exercise** as a directory name, even though Windows 95 will allow it. You are now ready to unpack the files and install the software.

III-1.2. Unpack the Files

If you are unpacking the exercise from a distribution diskette, insert the diskette into an appropriate drive. (If you have downloaded the .ZIP files, or have copied them to a directory on the hard disk, simply note the fully qualified directory name.) To unpack the files under Windows 3.n, begin by selecting **File**->**Run** from either the Program Manger or the File Manager menu. If you are running Windows 95, select **Start->Run**. In the box that appears enter the fully qualified path.

Examples:
1. To unpack the Jupiter exercise which is locatedon drive B: (the floppy drive), into the appropriate directory located on drive C: (your computer's hard drive), enter the following path:

B:\PKUNZIP -n-o-) B:\CLEA_JUP C:\CLEA\JUP_LAB

2. To unpack the files that have already been copied ontothe jard disk of the computer (drive C:\Files)inot the appropriate directory on drive C: (C:CLEA\JUP_LAB, enter the following path:

C:\Files\PKUNZIP -n-o-) C:\Files*.ZIP C:\CLEA\JUP_LAB

The significance of the control characters is as follows:

-n (minus n)   Assures that the user will always have the latest version of all files.

-o (minus "oh")   Overwrites existing (older, if used with -n) copies without prompting for confirmation.

-) (minus right paren.)   Prevents PKUNZIP from executing instructions (DPMI) that are not valid under Windows. (This option MUST be present, or your system will crash!)

Be sure you unpack all necessary files (see **NOTE** under III-1). If the distribution files (.ZIP) are on your hard disk, you can remove to them to conserve space once they are unpacked. (Be sure you have a backup copy on floppy disk before you delete anything!)

III-2. Installing and Running the Exercise

As a quick method of running an exercise after unpacking, access the File Manager (Windows 3.n) or Explorer (Windows 95). Access the directory where the you have loaded the files, and double- click on the entry for **CLEA_*XXX*.EXE**. Alternatively, select **File->Run** from either the File Manager or Program Manager menu (Windows 3.n), or **Start->Run** (Windows 95), and enter the appropriate command line,**C:*XXX*_LAB\CLEA_*XXX*.EXE**. For example, to run the Jupiter Exercise, the appropriate command line is **C:\JUP_LAB\CLEA_JUP.EXE**

As part of a permanent installation, and certainly for student use, the exercises should be installed under Windows. Follow the steps described below for Windows 3.n (Section III-2.1) and Windows 95 (Section III-2.2)

III-2.1. Installing the Software Under Windows 3.n

The procedure for installing CLEA exercises under Windows 3.n is as follows (assuming the software has been unzipped into directory C:*XXX*_LAB - see Section III-1.2):

1. If you have already created a program group to hold CLEA exercises, select it from the Program Manager window and go to step 4. If not, proceed with step 2.
2. From the Program Manager menu, select **File->New ->Program Group**. Click on **OK**.
3. Enter **CLEA Exercises** or other descriptive title in the Description field. The Group File field may be left blank. Click on **OK**.
4. From the Program Manager menu, select **File->New ->Program Item**. Click on **OK**.
5. Enter the following in the identified fields:
   For example, to install the Jupiter exercise, enter the following information

   > Description: Jupiter Lab
   > Command Line: C:\JUP_LAB\CLEA_JUP.EXE
   > Working Directory: C:\JUP_LAB
   > Shortcut Key: (None)
   > Run Minimized: (No)

6. Click on **OK**.

The exercise may now be run by selecting the **CLEA Exercises** program group from the Program Manager window, and double-clicking on the CLEA icon labeled with the exercise name. Follow steps 4 through 6 to place the remaining exercises into the Program group.

III-2.2. Installing the Software Under Windows 95

Use the following procedure to place CLEA exercises on the Start Menu in a folder named **CLEA Exercises**. Assume the current exercise has been unzipped into folder C:\CLEA\JUP_LAB or C:\CLEA\HUB_LAB (see Section III-1.2).
1. Select **Start->Settings->Taskbar**.
2. Select the tab labeled **Start Menu Programs**. Select the button labeled **Advanced**.
3. Click on the folder labeled **Programs**. If you have already created a folder for the CLEA exercises, open it by double-clicking and proceed to Step 4. If not, To create a folder: **Select File->New->Folder** from the menu. When the new folder appears, type **CLEA Exercises** (or other appropriate name) in the box and press the **Enter** key.
4. Select **File->New->Shortcut** from the menu. In the box that appears, type the name of the .EXE file for the exercise (include the full path to its location after unpacking.)
   For example: C:\CLEA\JUP_LAB\CLEA_JUP.EXE
   When finished, select the button labeled **Next**.
5. Enter the name of the exercise (such as Jupiter Lab) in the box that appears. When finished, select the button labeled **Finish**. There may be a slight pause before the completed shortcut entry appears, complete with icon.
6. You may if you wish add additional exercises by repeating Steps 4 and 5.
7. Close the Start Menu Explorer window (select **File-> Close**, or the **X** button in the upper right corner..
8. Select **OK** to close the Taskbar Properties dialog.

To run the exercise, select **Start->Programs->CLEA Exercises->Jupiter Lab**.

III-3. Installing CLEA Software on a Network

Users may wish to install CLEA software in a directory residing on a network drive to make it available to the students. Since the students are frequently not given write privileges in this directory, difficulties will arise when the CLEA software attempts to write various output files. Beginning with versions 0.95, CLEA software modules include features to facilitate operation in this environment. Once the software has been unpacked (Section III-1) or copied to the desired network directory, each exercise must be installed on the individual student machines in the manner detailed in Section III-2, with the modifications described in Section III-3.1 or III-3.2 below. Technical details of the handling of affected files are presented in Section III-3.3.

III-3.1. Windows 3.n.

Follow the steps given in Section III-2.1. In Step 5, you must set the Command Line to point to the network directory where the software is located, while the Working Directory must point to a "local" directory (probably on the student's machine) where the output files can be written.

> For example:
> Command Line: **E:\CLEA_LAB\CLEA_JUP.EXE**
> Working Directory: **C:\JUP_LAB**

When you have done this, complete the installation as described in Section III-2.1.

III-3.2. Windows 95

Follow the steps given in Section III-2.2, through Step 5. After completing Step 5, add the following:
   5a.   Move the cursor to the entry for the newly created shortcut, and click the right mouse button. On the pop-up that appears, select **Properties**.
   5b.   Select the tab labeled **Shortcut** at the top of the Properties dialog that appears.
   5c.   Verify that the entry labeled **Target** points to the network drive where the software is located. Go to the field labeled **Start IN** and enter the "local" directory path. For example:
   Target: **E:\CLEA_LAB\CLEA_JUP.EXE**
                           Start In: **C:\JUP_LAB**
   5d.   Select **OK** at the bottom of the Properties dialog and continue with Step 6.

III-3.3. File Handling

The following describes how various types of files are handled by the CLEA software (beginning with Versions 0.95) to facilitate operation in a network or other environment (such as a CD) where the system directory is read-only. In this discussion the term *system directory* refers to the path identified during setup in the **Command Line** entry (Windows 3.n, Section III-3.1), or the **Target** entry (Windows 95, Section III-3.2). The term "local directory" refers to the path identified in the **Working Directory** or **Start In** entry. (If there is no **Working Directory**/**Start In** entry the local directory will be the same as the system directory.) See Sections IV and V, and the Software Users' Guide for each exercise for additional information about the various file types mentioned.

> *Read-Only Files*: Executable modules (.EXE), bitmaps (.BMP), help files (.HLP), star field and object data (.DAT, .LST), and other files included in the distribution .ZIP files are expected to reside in the system directory. Errors will result if the software cannot find them there.

> *Software Options File*: When a CLEA exercise is started, the software attempts to read the appropriate options file (*XXX*OPTS.INI) from the local directory. If it cannot find it there it then tries the system directory. If the file still cannot be found the software accesses its internal defaults and attempts to write a new file to the local directory.

If this is unsuccessful the software simply ignores the error and continues normal processing. The software may also attempt to write an options file after an update (Section 5-1). Again, if it cannot write to the local directory it simply abandons the effort without a fatal error.

Log File: Each module's software attempts to write an entry to the log file (containing name and run time information) following student login, and again when the program is closed (via **File->Exit**). The **Log File** entry in the options dialog for each module can carry full path information, so that the log file can (if desired) be maintained as a shared file separate from either the system directory or local directory, most likely in a network file that is not read-only. If no path is provided with the log file name, the program attempts to write the file to the local directory. Any errors that occur during this process are ignored, and the log file information is lost.

Spreadsheet Software: Several of the exercises provide the ability to access separate spreadsheet software for data manipulation and analysis during the session. This software must be identified in the appropriate entry in the options dialog, which should carry full path information for access.

Output Data Files: In order to facilitate the use of spreadsheets, save generated data and provide for offline printing, several of the exercises can generate output files, usually in text format. If necessary, the students should be provided full path information for these files, which they should enter as part of the name in the dialog that appears when the files are saved. (The path defaults to the local directory if none is provided.) If the file cannot be written an error will occur. The student can then correct the problem and try again.

Spectra Index List: This file and its related spectrum data files are provided with the Spectral Classification exercise. They may also (optionally) be used with other exercises (Hubble Redshift and Large-Scale Structure) to provide authenticity (so that a stellar spectrum will appear if the student places the slit on a star rather than a galaxy). To facilitate this without requiring that either all of this fairly large body of data must be copied into the individual directories of all the labs that use it, or all the labs must be placed in the same directory, a field is provided in the options dialog where the fully-qualified file name may be entered. If the file name is entered without a full path, the software will look for the files in the system directory.

IV. Files Included With Exercise

The software module for each CLEA exercise includes a (largely) unique set of files that are vital to its operation. In addition to the executable code for the program (.EXE), these files hold the bitmaps for the screen displays (.BMP), data and parameters for the astronomical objects in the exercise (.DAT, .LST), text for the Help screens (.HLP), startup parameters (.INI), and documentation (.*XXX*). Many of these files can be modified or replaced to tailor the exercise to specific classroom requirements (see Section V). The following files are included with every exercise, and should be present after the distribution (.ZIP) file is unpacked (Section III-1):

README.*XXX* - Notes on the current version, including modifications and improvements, known incompatibilities with previous versions (if any), old files that should be deleted, etc.

UPDATE.*XXX* - A list of updates (by version) since the first released version.

USRGUIDE.*XXX* - Technical information specific to the particular exercise and version. The material in USRGUIDE.*XXX* extends and/or replaces information in the technical manual (this document).

CLEA_*XXX*.EXE - The executable code for the exercise.

CLEALOGO.BMP - 256-color bitmap data for the CLEA Logo screen.

CLEALG16.BMP - 16-color bitmap data for the CLEA Logo screen.

***XXX*LAB.BMP**   - 256-color bitmap data for the Title screen.

***XXX*L16.BMP**   - 16-color bitmap data for the Title screen.

CLEAHELP.HLP - Text for "Help"..."On Help".

***XXX*HLP.LST**   - Topic index list for Help.

***XXX*LAB.HLP**   - Text for Help topics.

REMINDER.*XXX* - Text to display when "Quit" selected (see Section V-5).

(***XXX*OPTS.INI**) - This file is not included in the distribution, but is created the first time the exercise is run. It contains default settings for options (see Section V-1.2). This file can be deleted if desired, it will then be re-created the next time the exercise runs.

(**Log File**) - This file (default **CLEALOG.LOG**) is created whenever an existing copy cannot be found. Records containing the login information (names and table #) and the time are written to this file at the completion of login, and when the user quits the exercise. The file is in text format, and information is labeled so that it can be easily printed or read with a text editor. If this file becomes too large it can be deleted and a new copy will be created.

In addition, many exercises include star field list and data files (see Section V-4.1). Most exercises further include other files that are unique to the exercise. These files are identified and described in the specific Software Users' Guide (USRGUIDE.*XXX*).

V. User Options

CLEA exercises are ready to run *as is*, in essentially the form that we have used with students in our introductory Astronomy classes. However, in order to make the exercises as flexible as possible, we have included a number of options that allow the instructor to tailor the exercise to specific course requirements and level of difficulty. This adaptability is provided through two mechanisms: an options dialog that enables the instructor to select built-in options and change file names and path; and the files themselves, which in many cases can be modified or replaced. General features of the options dialog are presented in Section V-1, while modifications to typical file types are discussed in Sections V-2 through V-5.

V-1.   The Options Dialog

CLEA exercises feature an options dialog that allows the instructor to select built-in options, change file names, and provide access to separate spreadsheet programs. A password is required for entry into this dialog to prevent access by the students.

V-1.1. Access and Password

Access to the options dialog is provided through the login (Student Accounting) screen. Select **Log In...** from the main menu, and type **Instructor** (not case sensitive) in the field labeled **Student #1**. No other entry on the form is required. After entering the above, select **Ok** and then **Yes** to **Have You Finished Logging In**?. A small dialog box will appear, asking for the password. Enter the password (see next paragraph), and select **Ok**. If you have entered the correct password, the dialog labeled **Startup Parameters/Options** will then appear. The tab key (and shift-tab) may be used to move from field to field, or you can select fields directly with the mouse. When you are finished select **Ok** or **Cancel**. If you select **Ok** the message **Save New Values in *XXX*OPTS.INI?** will appear. If you select **Yes**, the options as they appear on the dialog screen will be saved and used as defaults the next time the exercise runs. If you select **No**, the options you have set/selected will be used only for the current execution. Once you have made your selection the exercise will begin.

The default options password is **CLEA** (in caps). The default is in effect until it is changed, and at any time that the software cannot locate the *XXX*OPTS.INI file (see Section III-3.3). You may change the password from the options dialog (16 characters or less, case sensitive). If you do, a small dialog box will appear asking you to repeat the new password for verification. (Note that the password is never echoed, either when it is used or when it is changed.)   If the password change is verified you must also respond **Yes** to **Save New Values in *XXX*OPTS.INI?** to have the change take effect. The password is stored in a masked form in *XXX*OPTS.INI. If you forget the password, delete (or rename) *XXX*OPTS.INI and the password will again be **CLEA**. (In this case all options will return to their original (internal) default values.)

Once you have accessed the options dialog via the procedure just described, you can maintain access to it for the duration of your current run. When you first exit from the dialog (by selecting either **OK** or **Cancel**), a box will appear asking if you want to maintain access. If you select **Yes**, the options dialog will be accessible via **File->Preferences**...from the main menu (without a password) until you exit the program. If you select **No**, you will have to restart the exercise and follow the full procedure to get back to the options.

> **NOTE:** Optional accessibility to the options dialog throughout a run is provided to enable instructors to easily verify the effects of various options, and to "tune" various timing constants that affect simulations and animations. Since it is impossible for us to test on-the-fly changes to all parameters and options in all possible scenarios, users are cautioned that changes may occasionally yield unexpected results, ranging from no effect at all to possible system lockups or crashes. Options changes are best made when the software is in a relatively dormant state, with a minimum of windows open and no simulations running.

V-1.2. The Save Options File (*XXX*OPTS.INI)

The options settings for each exercise are stored in the file *XXX*OPTS.INI. This file is created and written to disk (see Section III-3.3) the first time a particular exercise is run, regardless of whether or not the options have been modified. (If they have not, the file will contain the internal defaults.) Whenever you select **Ok** from the options dialog and respond **Yes** to **Save New Values in *XXX*OPTS.INI?**, a new copy of *XXX*OPTS.INI is created and the old version is renamed *XXX*OPTS.BAK. If there is an existing *XXX*OPTS.BAK, it is deleted.

*XXX*OPTS.INI is stored in binary (not text) format. Changes should be made only via the options dialog, not with a text editor. If you are setting up the exercise on a number of computers in a laboratory, you can set up one via the options dialog, copy the resulting *XXX*OPTS.INI onto a floppy disk, and then load it into the appropriate directory on each machine.

Do not use a copy of *XXX*OPTS.INI with a different version of the exercise software than the one which created it. (In most cases this will be caught by the software and you will be given the option of deleting *XXX*OPTS.INI or quitting the program.) If you are updating an exercise *in place* (on top of an earlier version in the same directory), you should delete any *XXX*OPTS.INI and *XXX*OPTS.BAK files in the directory before running the new version. Remember that you may need either to reset some options or copy in a correct version of *XXX*OPTS.INI after you do this.

V-1.3. File Names and Directory Paths

File names may be entered in the identified fields on the options dialog. File names should follow the normal DOS format - a maximum of eight alphanumeric characters (first character must be alphabetic), optionally followed by a period and up to three characters as a qualifier. Bitmap files are given the qualifier .BMP, help files carry the .HLP qualifier, while data files and file lists are identified by .DAT or .LST. Note that there are usually 256-color and 16-color versions of each bitmap file (see Section II-4 for discussion). Details of each type of file are given in Sections V-2 through V-5.

File directory paths are determined as described in Section III-3.3. In some cases, including the Log file and external spreadsheet software, a complete path may be entered as part of the file name.

V-1.4. Parameters and Selectable Options

Most exercises have parameters and selectable options that allow the instructor to tailor the software for specific circumstances. These options and parameters are identified and described in the specific user's guide for each exercise (USRGUIDE.*XXX*).

V-2. Bitmap (.BMP) Files

Files that contain graphics images for display by CLEA software for Windows must be in Windows bitmap (.BMP) format. Many available software packages that edit or create graphics images offer .BMP file output as an option, and many will convert other formats (.GIF, .PCX, etc.) to .BMP. Unfortunately, you will find that .BMP files are usually larger than other formats, often much larger. Windows has apparently taken the route of trading memory/disk space for display speed.

V-2.1. Logo and Title Screen Bitmaps

Due to the color issues discussed in Section II-4, we provide 256-color and 16-color versions of the logo and title bitmaps. Many available graphics editing programs will reduce the number of colors to the standard 16 of VGA, and often offer a number of different techniques to accomplish this. We have found that methods which blend or "dither" the colors usually produce more satisfactory results than methods which simply map to the nearest color.

Users who wish to do so may provide their own logo and/or title screen(s) to replace the one(s) furnished. You will need to develop a 634x436 pixel image in .BMP format. Depending on the type of equipment you are using, you will need to create 256-color and/or 16-color versions. You can then enter the file names in the appropriate fields on the options dialog, or you can give your files the same names as the old ones and replace them in the system directory.

If you will always run in the same color mode (256-color or 16-color), you can free some disk space by deleting the unused .BMP files. Use the lists in Section IV and the user's guide to determine which .BMP files are for the mode you are not using, and can therefore be deleted. (The 16-color .BMP files usually have "16" somewhere in their name.) If you choose to delete files, be aware that you will need these files if for any reason you change the color mode or copy the software to a machine that runs in a different color mode (also see NOTE, Section III-1).

V-3. Revised CLEA Help Facility

New and recently revised CLEA software modules utilize an extension of the Help facility described in the initial version of this guide. The main features of the revised facility are a Help topic selection list, with related topics indented under group headings, and the ability to place the text for multiple Help topics in a single file. Both the selection list and the individual Help windows now include a string search capability to assist the user. As has been the case, all files related to the Help facility are in text format to facilitate modification or replacement by the instructor. The revised general Help facility is described in Section V-3.1. (This facility will eventually be used in all CLEA exercises.) The User Help (Section V-3.2) and logout **Reminder** (Section V-3.3) features are retained in their original format.

V-3.1. General Help Facility

The revised general Help facility includes several components. The Help Index file (Section V-3.1.1) identifies the available Help topics and provides for indentation under group headings when the list is displayed for selection. The text for each Help topic is placed in a Help Text file (Section V-3.1.2), under a topic heading that duplicates the Help Index file entry. A string search capability speeds topic searches in both the selection list and the individual Help windows. Its use is self-evident.

V-3.1.1. The Help Index File

The Help Index file identifies available Help topics for selection and points to the file containing the text for each topic. Entries in the Help Index file also provide topic grouping for indentation under group headings on the selection list.

Records in the Help Index file have the following format:

Field	Data Type	Contents
Topic/Group Hdr	String[65]	Topic or group header (see V-3.1.1.1 below) to appear on the Help selection list
Field Name	String [12]	Name of the file containing the text for the help topic (name + qualifier, no path). (See Section V-3.1.2 for the format of this file.) If the record's topic field contains a group header, this field must contain either 'begin' or 'end' (see v-3.1.1.1 below).

V-3.1.1.1. Topic Grouping and Indentation

Topics on the Help selection list may be grouped and indented under group headings. To identify a group, place a record in the Help Index file with the group header in the first field and 'begin' in the second. All topics below this header will be indented two spaces on the selection list until a record with the same group header in the first field and 'end' in the second is encountered. Groupings may be nested, each will indent an additional two spaces. Be sure that 'end' records for all groups are provided, in the opposite order of the 'begin' records. For examples, see any of the default Help Index files *XXX*HLP.LST provided with the exercises.

Group headings appear on the selection list with a "-" at each end. If the user selects a group heading from the dialog list, he/she is instructed to select a specific subtopic under the heading.

V-3.1.2. Help Text Files

Text for the Help screens is maintained in Help Text files (usually identified with the qualifier .HLP). If there is only one topic in the file, it may simply contain the text for that topic (as in the original Help files). If one file contains multiple topics, the text for each is entered under a topic header. Each topic header appears on a single line and must be identical to the entry in the first field of the Help Index file record (Section V-3.1.1), except that the Help Text file entry is enclosed in asterisks ("*"), rather than single quotes ("'"). There are no special rules for the text entered under the headers, except that a maximum of 72 characters per line is recommended. Users who create new Help text should check its actual appearance in a Help window. Variable width fonts can cause unanticipated changes in appearance.

Group headers do not have associated text, and therefore should not have related entries in a Help Text file. For examples of Help Text files, see the files *XXX*LAB.HLP provided with the exercises.

V-3.2. User Help File

We have provided the "User Help" menu item to accommodate specific instructions, information, etc. that the instructor may wish to impart to the students. To create a user help file, simply create a text file (we recommend a maximum of 72 characters per line), copy it to the system directory, and enter its name in the User Help File field on the options dialog. You can also use a text editor to modify the existing help screens or create replacements.

V-3.3. Logout "Reminder" File

This (optional) file provides a mechanism for the instructor to supply customized messages to the students when they have finished the exercise. The contents of the (text) file identified in the "Reminder File" field on the options dialog are displayed whenever "Quit" is selected from the main menu.

This display always concludes with the line **Select "OK" to Quit Exercise**, **"Cancel" to Continue**, and provides pushbuttons affording the appropriate choices. A reminder file can be any text file (create with a text editor), with the following restrictions:
- The total message may not exceed 1023 characters.
- A "line" (see next) may not exceed 255 characters.
- Carriage return-line feed (CRLF) characters in the file will result in new lines in the output.

However, additional new lines may appear because the output will wrap itself automatically. This wrapping depends on the video mode, and employs variable length characters, so the resulting line length is nearly impossible to predict. It is recommended that CRLF be used only to terminate paragraphs, which then become long lines (subject to the length restriction above). Some experimentation may be required to achieve a message that displays as intended.

We provide a default reminder file **REMINDER.*XXX*** with each exercise. This file may be used as is, modified with a text editor, replaced, or simply deleted, if desired. If no reminder file is available to the program, a short message ("Do You Really Want to Quit This Exercise?") is displayed when **Quit** is selected.

V-4. Data Files

In order to provide maximum adaptability, data for each exercise is read from files that can be created and/or modified with a text editor. The file formats used to identify and define sky fields are described in Section V-4.1 below. In addition to conforming to the appropriate format, input data files should adhere to the general rules listed below. (In order to interface with spreadsheet programs output data and results files have a slightly different format (comma separated values, or CSV), as described in Section V-5.)

1. Data should be entered one record per line.
2. Fields within records are separated by at least one space. Do not use commas or other separators, and do not embed spaces in numeric fields.
3. String fields are enclosed in single quotes ('), and the number of characters + spaces between the quotes must be $\le$ the maximum length of the field.
4. Real fields may carry a sign, and may be in fixed decimal (1.0, -2.345) or floating point (0.1234E-06, -8.549E+18) format. Real fields will also accept integer (0, 1, -99) values.
5. Integer fields may carry a sign, and cannot include a decimal point or exponent.
6. Boolean fields may be assigned only the values 0 (false. and 1 (true).
7. The maximum allowed values for all numeric fields (in terms of both absolute value and number of digits) are much larger than required for any reasonable values for the quantities they represent.
8. Values must be provided for all fields in a record, in the proper order. (Exception: if all remaining fields at the end of a record are empty, they may be omitted.. For null strings enter two single quotes (''), for null numeric fields enter 0 or 0.0.
9. There is no specific limit on the number of records in a file. However, these files are read into and maintained in memory when they are used, so there is some risk of running out of heap space with a large file. In addition, large fields can take a long time to load, which may cause annoying delays when slewing from one field to the next.
10. Do not include blank records in a file. Take special care to insure that there are no blank records at the beginning or end of a file.
11. Records should not contain carriage return, line feed, or other non-alphanumeric characters. Such characters may sometimes be inserted during file transfers by "Text Mode" protocols.

V-4.1. Sky Fields

The sky fields for each exercise are identified in a Sky Field List file (Section V-4.1.1). Data for each sky field is carried in a Sky Field Data file (Section V-4.1.2). In terms of format and purpose, CLEA sky field files are compatible with all exercises that employ them. (Sky Field files are currently used in *Photoelectric Photometry of the Pleiades*, *The Hubble Redshift-Distance Relation*, *The Classification of Stellar Spectra*, and *The Large-Scale Structure of the Universe*.) However, data sets supplied with one exercise may not contain specific information required by another.

For example, the sky field data supplied with most of the exercises does not contain color information, and thus could not be used with the ***Photoelectric Photometry*** software to obtain photometric colors. (Instructors, of course, are free to add color information to the data if they so choose.) For specific information on the sky field data included with any exercise, see the associated **Software Users' Guide** (USRGUIDE.*XXX*).

When creating new sky fields for an exercise, or modifying existing fields, give consideration to the following:

1. The "finder" (wide) field of the simulated telescope is 2.5 degrees square. Users should, in general, provide fields that are at least 5 degrees square to allow slewing from edge to edge of the field that first appears.
2. Fields should not be larger than 8-10 degrees square.
3. Avoid high declinations (stay within -60 < dec < +60). The display algorithm is relatively simple, basically a "square" projection.
4. Similarly, avoid fields that straddle the 24Hr/0Hr dichotomy in right ascension. (The program will not identify a coordinate of, for example, 23Hr 50Min RA as being "near" one at 0Hr 5Min, etc..)

V-4.1.1. The Sky Field List

This file provides a list of the files that contain the data for each sky field, along with the coordinates of the field centers. It is identified in the field labeled "Sky Fields List" on the Options dialog (Section V-1); the naming convention is *XXX*FILES.DAT. Records in this file have the following format (see general rules under V-4.1):

Field	Data Type	Contents
File Name	String[12]	Name of Sky Field Data File (name + qualifier, no path).
Right Ascension	Real	RA of field center in decimal hours (0.0..24.0, but see Section V-4.1).
Declination	Real	Dec of field center in decimal degrees (-90.0..+90.0, but see Section V-4.1).
Field Name	String[20]	Field identification for selection lists.
Default	Boolean	One record in the file may carry a 1 (True) in this field to identify the default sky field. All other records should carry a 0 (False) in this field.

The sky field list is searched for the nearest field whenever the telescope is moved (via the "Set Coordinates" button) or slewed (using the N-S-E-W buttons).

V-4.1.2. Sky Field Data Files

These files contain positional and other data for each star and other object (galaxy, etc.) in a field. Each entry in the Sky Fields List (Section V-4.1.1) identifies a field data file, which must be present in the system directory when the exercise is run. (Note that these files are not identified on the Options dialog (Section V-1).) The user may add as many sky fields as desired by supplying corresponding entries in the Sky Field List, and may also add, delete, or modify data in the files provided.

Sky Field Data File records have the following format (see general rules under V-4):

Field	Data Type	Contents
Galaxy/Star ID	String[15]	Optional name, Messier/NGC number, HD/BD number, or other identification. *Note 1*
Right Ascension	Real	RA of object in decimal hours (0.0..24.0).
Declination	Real	Dec of object in decimal degrees (-90.0..+90.0).
V Magnitude	Real	Apparent magnitude of object.
B-V Color	Real	Apparent Color Index.
U-B Color	Real	Apparent Color Index.
Z	Real	Redshift(=Delta_Lambda/Lambda)
(Unused)	Real	For future use.
(Unused)	Byte	For future use.
(Unused)	Byte	For future use.
(Unused)	Byte	For future use.
Object Code	Byte	Identifies object as a star (0), or galaxy (1).
Image Index	Longint	Index number of the associated "large" galaxy image bitmap in the galaxy image list file (galaxies). For stars, this field contains the spectral type code.
Comment	String[23]	Optional additional information. (The supplied files may carry the stellar spectral type in this field. On galaxy records, the field is blank.) *Note 1*.

Notes:

(1)   Enter two single quotes ('') to blank out this field.

V-5.   Using a Spreadsheet Program

To provide for data reduction and graphing, new and recently revised CLEA software modules include the (optional) capability to save results data as it is obtained by the student, write the data to a file formatted for input to most spreadsheet programs, and access an identified spreadsheet program from within the exercise.

The format of the transfer file is Comma Separated Values (CSV), a text file in which commas (no spaces) separate each field (including empty fields), and string fields are enclosed in double quotes ("). When this format is read into a spreadsheet (see below) the commas separate the data into columns. The specific contents of this file are described in the associated **Software Users' Guide** for the exercise.

If the software finds an entry in the **Spreadsheet Program File** field on the File Name Options dialog (Section V-1), the **Spreadsheet** item on the **File** popup is enabled. Selecting **File->Spreadsheet** from the main menu will then start the spreadsheet software. (Before accessing the spreadsheet, the students must save their current data and record the file name.) The exact technique for loading the .CSV file depends on the spreadsheet. As examples, the .CSV file type can be opened directly into Microsoft Excel Version 4.0 and Lotus 123 Version 5.0, while Lotus 123 Version 2.2 requires **File->Import->Numbers**. To return to the exercise, students may either minimize the spreadsheet program or exit from it (after saving any modified data).