

PLOT TOOLS

VERSION 2.0

FOR 32- AND 64-BIT WINDOWS

15 JULY 2014

Introduction

While a student in the JN and N classes, I made extensive use of my computer. It started off as a data collection device, where I entered my sight data into a spreadsheet. As data collection progressed to sight reduction, I added calculations to the spreadsheet to check for errors. Law of Cosines was included as yet another check and the usage grew. The spreadsheet served me well through JN. When we hit the meridian diagram in N, I decided to write a program to help me understand the mechanics involved. Drawing the diagrams manually was time consuming and the computer provided a vehicle to easily experiment with "what if" scenarios. As the N exam approached, I decided that I would have to spend some time drilling myself on several areas in the course. Once again I turned to my computer and wrote a program which would randomly ask me questions and show me the answers when I asked for them. The night before the exam, I drilled myself until I could answer all the questions without error. During both courses, I had frequent interactions with the "Sight Checker". We compared notes on my spreadsheet and the program he used to check the sights submitted. When I asked him what he used to check the plot, he indicated that each sight had to be plotted for verification. Once again, I turned to my computer and wrote the CLS Plot program. The program prints a plot which can overlay the submitted sight for verification. Plot Tools is the collection of this learning process.

Note: For program support, contact Stan Klein at slk1000@aol.com.

Installation

System Requirements

Operating System: Windows 95 or later (any 32- or 64-bit Windows version)

CPU: Even an Intel 386 w/8MB memory will work, but very slowly. Disk Storage: Requires 1.5 MB storage.

Installing the software

Plottools is provided as a zipped archive, plottool20setup.zip. These installation instructions are for Plottools 2.0 (64-bit compatible edition), dated July 15, 2014:

- 1) Create a folder for the installation program, say c:\plottoolsetup
- 2) Unzip plottool20setup.zip into the directory you created in Step 1.
- 3) Click the Start button, click All Programs, click Accessories, then right-click Command Prompt. On the pop-up menu, click "Run as administrator". If you get a message box saying "Do you want to allow...", click Yes.
- 4) When the Administrator Command Prompt window opens, type the following at the prompt:

```
regsvr32 c:\plottoolsetup\mfc40.dll
```

(Replace c:\plottoolsetup with whatever folder you selected in Step 1.)
Hit Enter.
- 5) Go to the folder created in Step 1.
- 6) Double-click on the "setup" (setup.exe) program. Answer any questions appropriately to allow Plottools to be installed.
- 7) Find the PLOTTOOL folder. In a 64-bit Windows version it will be in c:\Program Files (x86). Start Plottools by double-clicking PLOTTOOL (PLOTTOOL.exe). If you choose to, make a desktop shortcut for PLOTTOOL.exe.
- 8) Once installation is completed the folder created in Step 1 can be deleted, including its contents.

Known bugs

There are certain things in version 2.0 that do not work exactly as they did in version 1.5. Some may be considered better, some worse. For example, in the version 1.5 CLS Plot, if the left mouse button were held down while in the plot area while the mouse moved, as the red box passed over any lines on the CLS form, those lines were erased, but reappeared as soon as the mouse button was released. In the version 2.0, the lines are not erased, but the entire CLS form is constantly being redrawn as the mouse is moved, giving an annoying flickering effect.

Also in the version 2.0 CLS Plot, when creating a temporary range/bearing vector by holding down the shift key while dragging the cursor across the plot area, the shift key must be pressed before the mouse button or the vectors will not erase as the cursor is dragged. (The vectors will erase as soon as another point is plotted.) This is not really a problem, since the shift key must be pressed before pressing the mouse button anyway, otherwise a new reference position will be created. (See instructions at the top of page 5.)

One thing that might be considered an improvement is that in version 2.0 each window opens in its normal size instead of being maximized, as in version 1.5.

Execution

The Plot Tools program may be run by double-clicking on PLOTTOOL (PLOTTOOL.exe) in the PLOTTOOL folder or the desktop shortcut if created. When the program begins execution, it will display its About Screen showing version information. The About Screen is shown for 15 seconds or until you click on the screen. After the About Screen has been removed, a "toolbar" will appear in the upper left corner of your display indicating "Plot Tools".



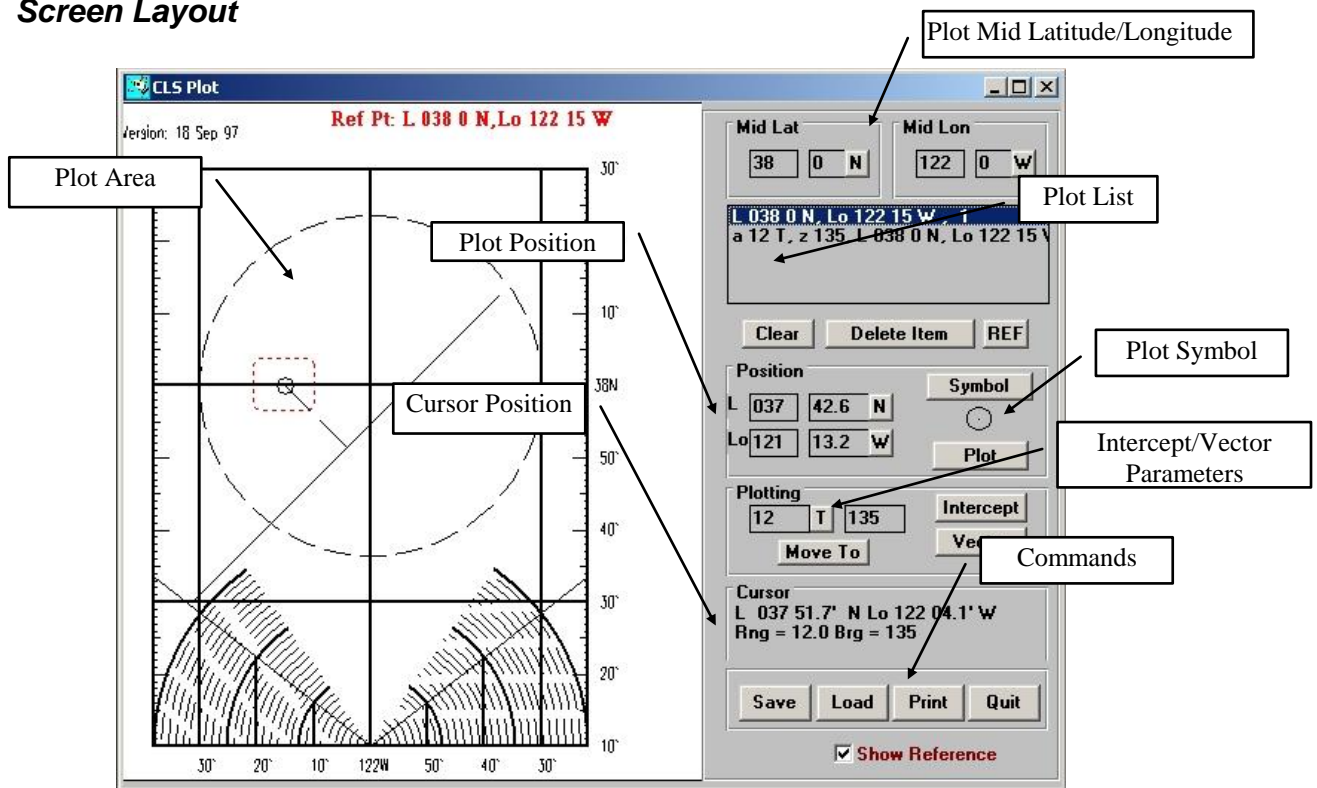
The "toolbar" contains five icons, three of which are used to select the other programs. Moving the mouse cursor over an icon will display the function it will activate (from left to right: About, CLS Plot, Quiz, Meridian, Quit). Click on the icon to activate the function. . (The leftmost icon opens the About Screen. Click on the About Screen to close it. The STOP icon closes the toolbar but not any running function.)



CLS PLOT

This program plots points, intercepts, and vectors on a Constant Latitude Scale chart. You specify mid latitude and longitude for the plot and the program will reproduce the scales and markings of the USPS Form CLS98 (or earlier). When printed, the plot should accurately overlay Form CLS98 and thereby provide a means for checking sight reduction plots. The printed form deviates from a correctly plotted CLS98 form by printing the longitude scale on the lowest latitude line of the 1° x 1° plot area, rather than at the bottom of the page. This deviation was necessary to maintain scale and avoid printing outside the print area.

Screen Layout



CLS Plot Screen

Plot Area

The left hand side of the screen represents the actual CLS plot. Both Latitude and Longitude scales are based upon the Mid Lat/Lon settings. As the Mid Latitude is change the longitude scale construction lines are redrawn to reflect the new settings. Symbols, intercepts, and vectors (lines) are plotted in the plot area. Symbols denote points. An Intercept represents a Line of Position and the construction lines used to construct it. A Vector is simply a line drawn from a point for some distance at some angle.

Mid Latitude/Longitude

The mid latitude and longitude are entered in degrees and minutes with a button for selecting the "name". Separate fields are provided for degrees and for minutes. The "name" button alternates the selection. If the latitude name is "N", clicking on the button will change it to "S". The same goes for longitude, except the possible names are "E" or "W". The plot is updated after focus moves from the data entry field.

Plot List

Points, intercepts, and vectors are accumulated in the Plot List. The CLEAR button empties the list and erases the plot. A "Delete Item" button provides for clearing individual (highlighted) entries in the list. The REF button lets you make the Lat/Lon of a point in the list the "reference point".

Plot Position

The plot position is defined by latitude and longitude which is entered in degrees and minutes with a "name" button. Separate fields are provided for degrees and for minutes. The "name" button alternates the name selection. If the latitude name is "N", clicking on the button will change it to "S". The same goes for longitude, except the possible names are "E" or "W". Changing the plot position alone causes no change in the plot.

Plot Symbol

Each point is plotted with a symbol. Click on the "Symbol" button to popup a menu for selecting the desired symbol. There are six symbols to choose from:

1. Plus sign (+)
2. Fix (o)
3. Dead Reckoning (DR) (∩)
4. Estimated Position (EP) (□)
5. Known Position (KP) (Λ)
6. Dot (.) (was asterisk in previous versions, but plotted and printed as a dot)

Selecting the symbol changes the displayed selection, but has no effect on the plot. A point is plotted when the "Plot" button is selected or when you click in the Plot Area.

Intercept/Vector Parameters

Intercepts and vectors use the Plot Position as a reference. Distance is entered as nautical miles and the A/T button is used to select Away or Toward. Azimuth is entered in the Zn field. To plot an intercept, click on the "Intercept" button. To plot a vector, click on the "Vector" button. To alter the Plot Position using the entered distance and direction, click on the "Move To" button. This will not plot any lines; it will only change the Plot Position.

Cursor Position

Whenever the cursor is moved into the plot area, it will change to a "cross hair" and the Cursor panel will be updated with latitude, longitude, and the range and bearing from the "reference point" to the cursor. Clicking on a point in the plot area will enter the cursors position as a new "reference point" and add it to the points list for plotting. The current Symbol selection will be used to plot it.

The significance of the "reference point" is that the Lat/Lon are printed on the CLS chart. This may be used to record a fix or estimated position. The location of the "reference point" may be determined by the readout above the plot and a dotted line highlight (both are red in color).

A temporary range/bearing vector may be displayed from the reference point to the cursor position by holding down the shift key while dragging the cursor across the plot area. The shift key must be pressed before pressing the mouse button, otherwise a new reference position will be created.

Commands

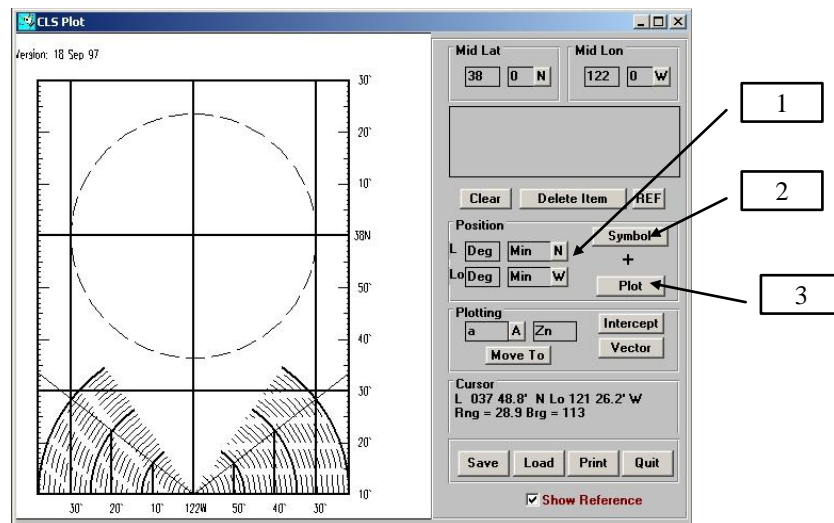
SAVE - The “Save” button provides for saving the plot. Clicking on the button will prompt you for a file name to store the file. The plot data is stored in a text file.

LOAD - The “Load” button restores the data previously saved and displays the plot.

PRINT - The “Print” button causes the current plot to be printed.

QUIT - The “Quit” button terminates the CLS Plot program.

How To Plot



To plot a point when you know the latitude and longitude:

1. Enter the latitude and longitude into the Lat/Lon position fields.
2. Select the desired plotting symbol by clicking on the “Symbol” button and choosing a symbol from the popup menu.
3. Select the “Plot” button and the point is entered into the points list and drawn in the plot area.

To plot a point visually:

1. Select the desired plotting symbol by clicking on the “Symbol” button and choosing a symbol from the popup menu.
2. Position the cursor over the desired location and click.



MERIDIAN

This program will display and print Meridian Diagrams, Time Diagrams, and a version of the Meridian Diagram used to calculate Great Circle Cn and Distance. The program gives the option (selected with a checkbox) of drawing the hour circles and vertical circles as circular arcs or ellipses for the Meridian and Great Circle diagrams. (It has no effect on the Time diagram.)

Plot Area

Horizon System Parameters

Zenith Position

Equator System Parameters

Meridian

Display Selection

Form

Print

Quit

Revised 19Jan2000

Screen Layout

Plot Area

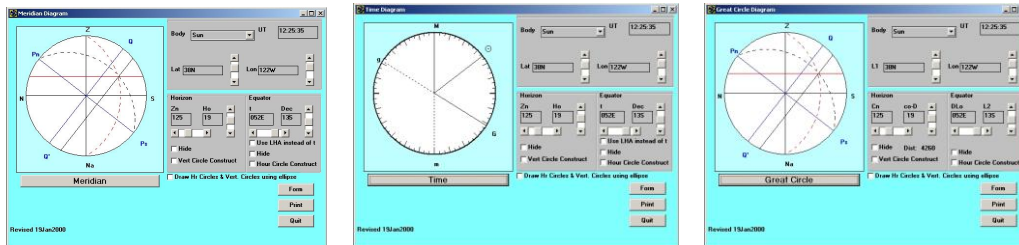
The selected diagram is plotted in this area. The initial diagram is the Meridian Diagram. A Time Diagram and Great Circle Diagram may also be displayed. For the Meridian and Great Circle diagrams, colors are employed to distinguish between the two coordinate systems.

<u>System</u>	<u>Axes</u>	<u>Circles, etc.</u>
Equator	Blue	Green
Horizon	Black	Red

The Time Diagram is plotted black on white.

Display Selection

Display selection is accomplished by clicking on the Display Selection button. The sequence starts with Meridian followed by Time, followed by Great Circle and finally back to Meridian.



Horizon System Parameters

Parameters for the Celestial Horizon coordinate system include Z_n and H_o . These values may be entered into the fields provided or by adjusting the “slider” associated with each. Two checkboxes are provided to control what is displayed. The “Hide” checkbox is provided to hide the horizon system plot from view. The “Vert Circle Construct” checkbox is provided to control the display of the construction lines which would be used to draw the vertical circle (checked means display it).

When the selected display is Great Circle, the labels are changed from Z_n to C_n and H_o to $Co-D$. In addition a distance field is added.

Equator System Parameters

Parameters for the Celestial Equator coordinate system include t or LHA (chosen with a checkbox) and Declination. These values may be entered into the fields provided or by adjusting the “slider” associated with each. Two checkboxes are provided to control what is displayed. The “Hide” checkbox is provided to hide the equator system plot from view. The “Hour Circle Construct” checkbox is provided to control the display of the construction lines which would be used to draw the hour circle (checked means display it).

When the selected display is Great Circle, the labels are changed from t or LHA to DLo and Dec to $L2$. In addition the Latitude label is changed to $L1$.

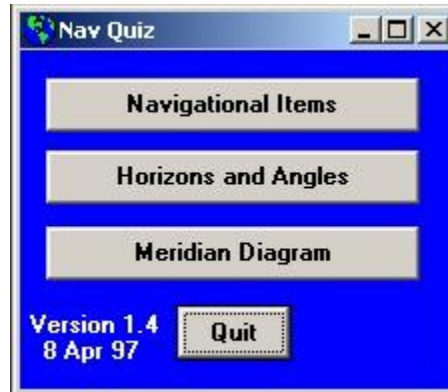
Zenith Position

The Latitude and Longitude of the Zenith Position may be entered into the fields provided or via the “sliders”. In addition to positional information, Body, UT, and (if the body is a star) SHA may also be entered. This data is of primary use in the Time Diagram.

NAV QUIZ



This program is intended to "drill" the JN/N student in three areas. Navigational Coordinates, Horizon/Angles, and the Meridian Diagram. This initial form provides three buttons for selection of each area.



Navigational Coordinates

This form presents you with a "Navigational Item" and prompts for up to three pieces of information: Measured From, Measured Along, and Measured To. Text boxes are provided to enter your answer.

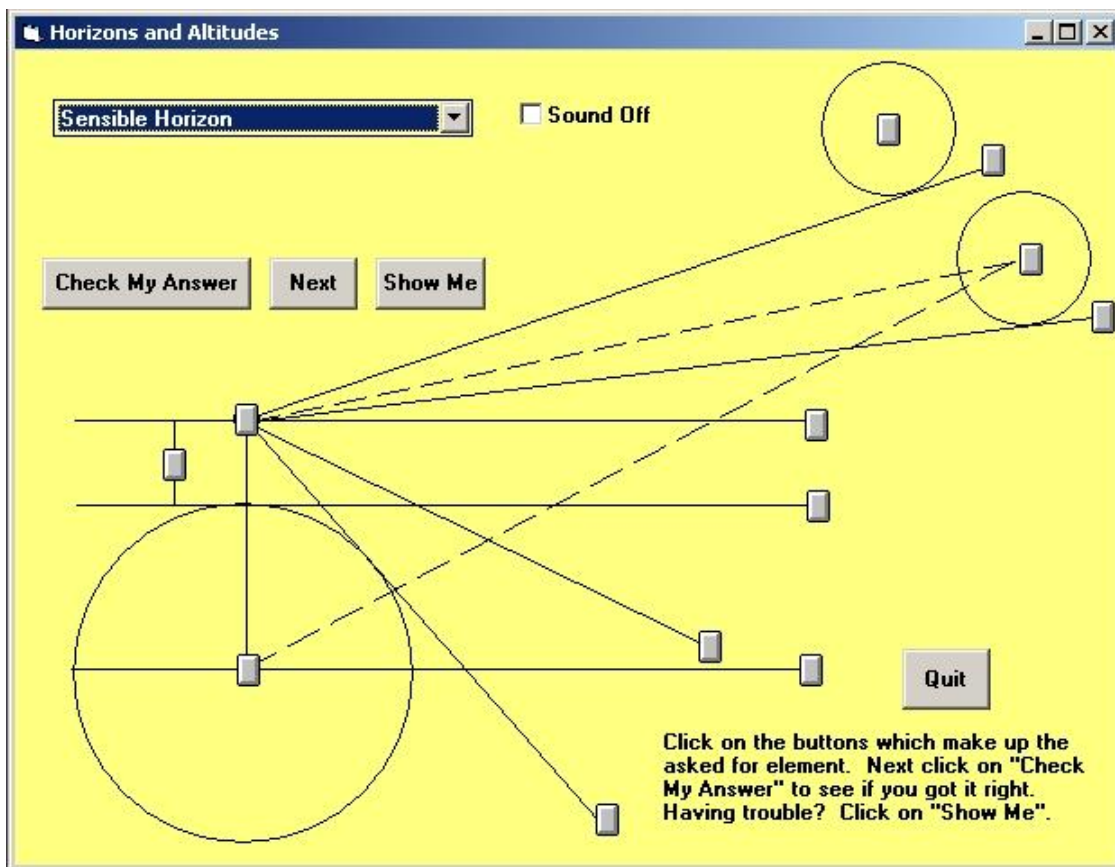
Note: the program does not look at the data entered.

After entering your answer, you may view the correct answer by clicking on the "Show Answer" button. If you feel your answer is correct, click on the "Right" button otherwise click on the "Wrong" button. You are on your honor. The number of correct and incorrect answers is accumulated and displayed. After you have

answered each question correctly the number of times specified in the "Correct Answer Threshold" box, the program will move to the Horizons and Angles form. The threshold may be changed to require more correct answers if desired. Changing the threshold resets the correct/incorrect tally. It should be noted that the list of questions has been expanded beyond Navigational Coordinates so that the definition of Civil Twilight, SHA of the Sun on 21 March, and other concepts could be included.

Horizons and Angles

This form displays a diagram of the horizons and angles which come into play when taking a sight of the Sun's Lower Limb and reducing it.



Click on "Next" to get the next question then click on the points which define the asked for horizon or angle. When all points have been selected, click on "Check My Answer". A correct answer increments the correct answer tally and calls up the next question. An incorrect answer is recorded and a "Sorry" box displayed. Further attempts may be made to get the correct answer. Audio encouragement is available by turning off the "Sound Off" checkbox. If you are having difficulty finding the correct answer, click on the "Show Me" button.

Meridian

This form works the same way as Horizons/Angles except the diagram is of a Meridian Diagram..

The screenshot shows a software window titled "Meridian Diagram". On the left is a circular meridian diagram with a vertical axis labeled 'Z' at the top and 'Na' at the bottom. A horizontal axis is labeled 'N' on the left and 'S' on the right. Other points labeled include 'Q' at the top right, 'Pn' on the left, 'M' on the right, 'Ps' at the bottom right, and 'Q'' at the bottom left. A red square is placed at point 'M'. On the right side of the window is a control panel with a yellow background. It features a "Sound Off" checkbox, a "Hour Circle" dropdown menu, a text input field containing "Pn, M, Ps", and four buttons: "Check My Answer", "Next", "Show Me", and "Quit". Below the buttons, the text "Correct = 1 Incorrect = 0" is displayed.

Order of selection is important. A "Show Me" button is provided to display the right answer when you are stumped.