Creating Maps using Canvas: Beginner's Guide

1.0 Introduction

The purpose of this guide is to help beginning digital cartographers lay out and draw cave maps electronically. Many of the suggestions here are my personal preferences, including line weights and layer names, and can be changed to meet the needs or preferences of the cartographer. The guide assumes that the user is at least generally familiar with the Windows operating environment, Windows-based programs, and the basics of cave mapping and cartography. Some familiarity with drawing programs is helpful, but not necessary to use this guide. This guide will not teach you all of the tools available in Canvas. Use the on-line help and manuals to find tricks and shortcuts for some of the more common tasks.

1.1 Why Digital?

Digital cartography increases the flexibility of cave maps. Updating and adding new passages to digital maps is relatively easy and faster than with convention pen-and-ink maps. Digital maps are easier to scale for multiple purposes (wall maps vs. publication maps) and are much easier to integrate into GIS, web sites, digital documents and other forms of electronic publishing. Photographs and color geology can easily be added to digital maps to present more information than conventional maps. In general, digital cave maps are more dynamic and adaptable than other types of maps.

1.2 Drawing vs. CAD Programs

There has been a great deal of debate about what kind of programs work best for drafting cave maps. CAD systems (AutoCAD, IntelliCAD, Microstation) are great for maintaining real-world coordinate systems and are easily integrated into GIS. Drawing programs (Canvas, Illustrator, CorelDraw) contain more freehand and image editing tools. However, the biggest advantage drawing programs have over the CAD programs is their shorter learning curve. Traditional cartographers can learn to use drawing programs much faster than trying to learn the specialized lingo and skills of technical drawing.

2.0 Getting started

Start Canvas using the start menu. A new drawing will automatically appear in the window. If you want to continue work on an existing drawing select **Open** from the **File** menu. A dialog box will appear so you can select a file. If you make a mistake in a drawing and want to start over, select **New** from the **File** menu. A selection box will appear with several drawing options, illustration, publication, or presentation. Select the **Illustration** option for doing cave maps.

2.1 The menus and toolbars

The top of the work area contains three parts, the menu bar, the toolbar and the docking bar (figure 1). The menu bar is a set of pulldown menus with commands and tools. The Toolbar contains buttons you can click to choose commands, tools, inks, strokes, and styles. To display the Toolbar: select **Window** > **Palettes** > **Show Toolbar**. To hide the Toolbar: select **Window** > **Palettes** > **Hide Toolbar**. The docking bar allows you to keep palettes such as the document setup palette, and macro box "docked" at the top of the screen, so you don't have to go through the pulldowns or Tool Box to get to your most-used features.
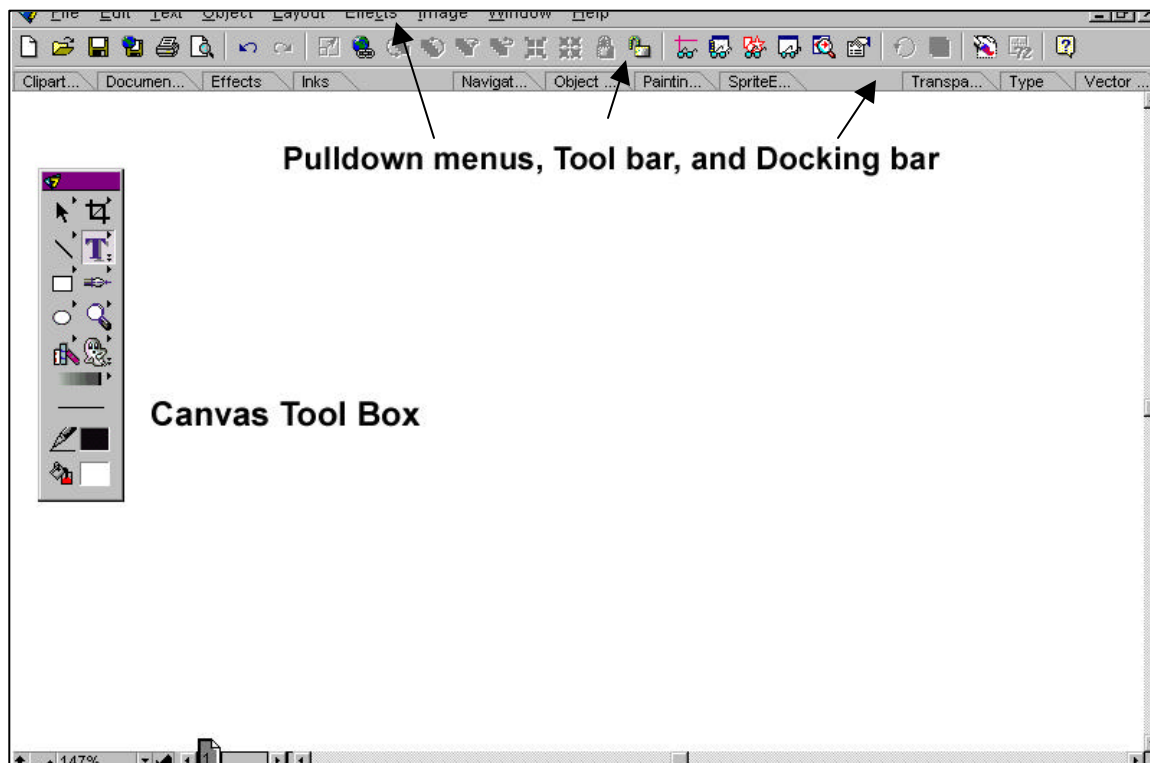

Figure 1. The Canvas work area

2.2 Document set-up and layout

To set up the blank page, go to the **Layout** menu and select **Document Setup**. A dialog box will appear that gives you the options for setting up the drawing environment. You can choose any standard paper size by selecting it in the illustration size pulldown menu. You can also define your own map size using the custom option in the illustration size pulldown menu and then typing in the dimensions manually. These settings can be changed later without affecting your drawings if you decide you need more or less space later.

2.3 Suggested layers

It is best to keep different types of information on different layers. This helps to avoid cluttering the screen with too much information during drawing and it helps to create different types of maps later on. To create, delete, or modify layers go to the **Layout** menu and select **Document Layout**. The document layout palette (Figure 2) will then appear. Click the + sign next to the text that says Page 1 and the list of layers will appear. Click on the layer name (Layer 1 is the only layer in a new drawing) and then click the **New Layer** button at the bottom of the document layout box. To change the name and other parameters of a layer, double-click the layer name. Below is a table of layer names that I use and what they contain:
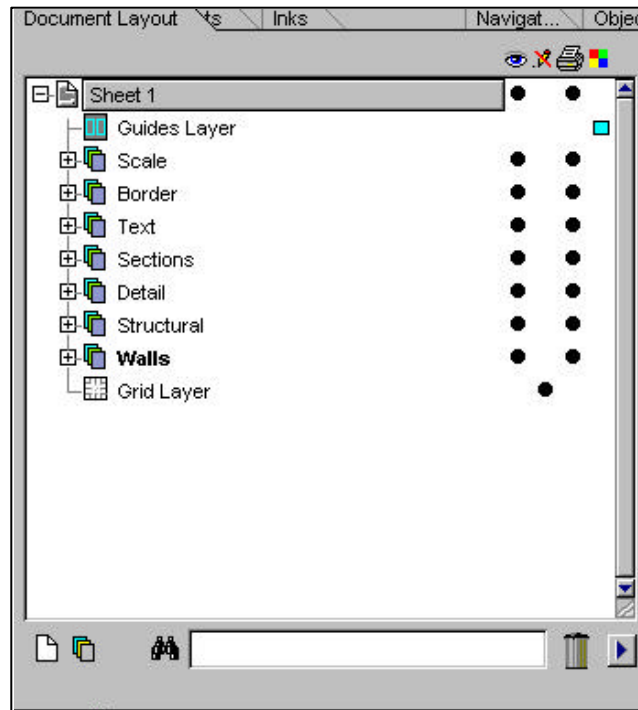

Figure 2. Document layout palette

Name	Contains
Walls	passage walls, bedrock pillars
Structural	symbols representing changes in ceiling height, slopes, pits, domes, dropoffs, etc.
Detail	floor detail such as sand, mud, bedrock, stalactites, stalagmites, breakdown, etc.
Cross-sections and ceiling heights	ceiling height circles and passage sections
Elevations	passage elevations
Stations	survey station symbols and station labels
Text	passage labels and other text items
Scale	scale bar and north arrow
Bitmap	the scanned and assembled bitmap of the cave or cave passage

In general, it's best to keep the bitmap as the bottommost layer since everything will be drawn over the bitmap. The order of the other layers is not as important and can be customized to your needs.

2.4 Creating bitmaps

In order to create a digital cave map, you will need an original pencil drawing of the map or passage first. You can either scan in the pencil version of the map or digitize it directly from a digitizing tablet. The following procedures are for scanning and digitizing on-screen using the mouse.

If you are dealing with a small cave that fits on only one or two survey pages, you can just scan the original notes into the computer. For a longer cave, I suggest drafting the pencil version of the map on gridded paper first and then scanning in the pencil map. It is possible to assemble larger cave maps using scans of original notes, but that requires importing the line plot into the computer and a lot of manipulation of the notes that is currently easier by hand. It is recommended that you draft on gridded paper (mylar, velum, etc.) so that you can reassemble the map from the scanned pieces.

Each scan will result in a bitmap image to be saved on disk. I generally use either the TIF or JPEG file formats since they give the best quality for the smallest file sizes. These bitmaps will be reassembled in Canvas later.

2.5 Assembling bitmaps

Unless you have a map scanner, you will probably have to scan your pencil map into the computer in smaller pieces. If possible, try and keep the page straight in the scanner. This will speed up the process of assembling the map in the computer. Otherwise you may have to rotate the bitmaps so that north is the same direction on each one.

Go to the **Layout** menu and select **Document Layout**. The document layout palette (Figure 2) will then appear. Click on the layer named *Bitmap* to make it the active layer. Click on the drawing space to make it active and then select **Place** from the **File** menu. A document dialog box will appear. Choose the format you want to input and then the first bitmap image of your pencil drawing. Make sure that the option to "Place on Current Layer" is checked. An angular cursor will appear on the screen that will allow you to place the bitmap. Click on the drawing and Canvas will import the bitmap. Repeat these steps for every bitmap you have scanned in.

Using the gridlines on the scans, move the bitmaps back together. You may have to rotate the bitmaps slightly to make them fit. Go to the **Effects** menu and select **Rotate**. In the rotate dialog box, you can type in the exact angle of rotation. It may take several tries to get the correct rotation. When you have assembled all of the bitmaps together, select them all by dragging a box around them with the cursor. You may have to zoom out using the magnifying button on the toolbox to see all of the bitmaps. After they have all been selected, go to the **Object** menu and

select **Group**. This will make all of the bitmaps into one object that you can move around the space. This will also prevent you from inadvertently disassembling the bitmaps as you work.

2.6 Setting up the map

Try to center the assembled bitmaps on the page. You may have to go back and change the page dimensions using the page set-up procedures described above. Leave enough room to put in passage names, ceiling heights, elevations, etc. You are now ready to begin drawing the cave map.

3.0 Drawing the Cave (Plan View)

Line Weights

1.5   Walls, including bedrock ceilings in the profile and cross-sections
1.0   Structural details and floors in the profile and cross-sections
0.5   Floor detail on plan, profile, and cross-sections

I also use rounded corners and ends for all of the lines

3.1 Walls
It does not matter what order you digitize the map features in, but it is best to only work with one layer at a time. I generally do the walls first, then the structural features, and then the floor detail. Go to the **Layout** menu and select **Document Layout**. The document layout palette (Figure 2) will then appear. Click on the layer named *Walls* to make it the active layer. On the toolbox, make sure that the fill is set to no fill, the line color is set to black and that the line weight is set to 1.5.

 Curve Tool

Select the curve tool shown above and begin tracing the walls. Each left mouse click you make will add a point to the line. Double-click a point to end the line. If you accidentally close the line and didn't mean to, just double-click the line, select the curve tool, and keep drawing.

3.2 Structural

Go to the **Layout** menu and select **Document Layout**. The document layout palette (Figure 2) will then appear. Click on the layer named *Structural* to make it the active layer. On the toolbox, make sure that the fill is set to no fill, the line color is set to black and that the line weight is set to 1.0.

 Line Tool

For some of the structural detail (such as floor drops, domes, pits, etc.), use the curve tool to draw the overall shape and the line tool to make the hatchures. For changes in ceiling height, you can draw a dashed line and then add the hatchures using the line tool.

3.3 Details

Go to the **Layout** menu and select **Document Layout**. The document layout palette (Figure 2) will then appear. Click on the layer named *Details* to make it the active layer. On the toolbox, make sure that the fill is set to no fill, the line color is set to black and that the line weight is set to 0.5.

For symbols such as breakdown and flowstone, use the curve tool. For standard symbols, you may want to use some built-in symbols which Canvas calls macros. The macros can be found on the toolbox (figure 3) as the symbol that looks like shelved books.
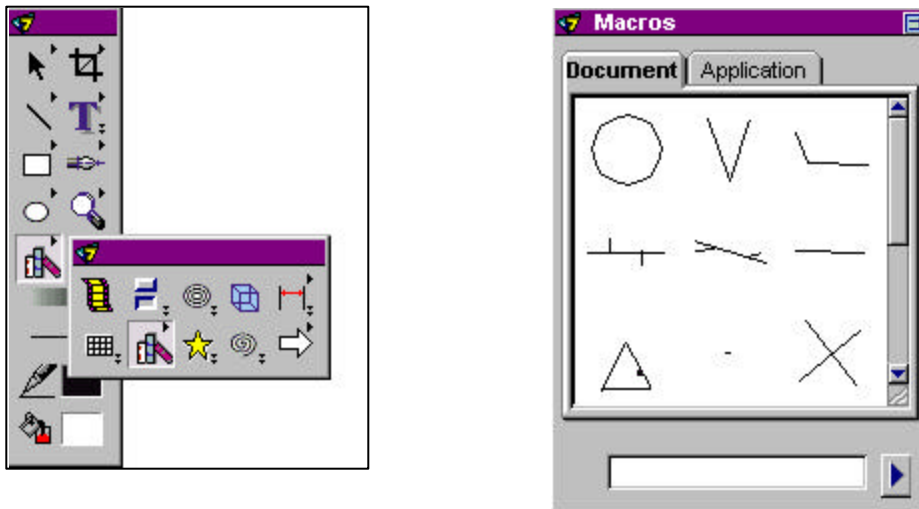

Figure 3. Macro Tool in toolbox

In order to set up the macros for the first time, drag the symbol into the work area as shown in figure 4. In the lower right corner, select the arrow and Canvas will display several options. To load an existing set of symbols, select Append Set and Canvas will display a file dialog box and you can select the palette that contains the symbols. Canvas 5 uses a *.pal extension and version 6 and 7 use a *.mcr extension.

The symbols appear in the macro box. To use them, just click on the symbol you want and then click on the part of the map where you want it. To place the same symbol many times, make sure you have "retain selected tool" selected in your **Preferences** under the **File** pulldown menu. If "Retain selected tool is selected, every time you click the left mouse button, the selected symbol will appear.

If you want to create your own symbol, draw it using the drawing tools, group all of the parts of the new symbol together, and then drag it into the macro box. Remember, if you want to make your new symbol part of the master symbol set, you will need to click on the arrow on the lower right of the macro box and choose "Save Set."

3.3 Cross-sections and ceiling heights

Drawing the cross-sections is the same as drawing other parts of the map except you use different line weights on the same layer. I use 1.5-point lines for the bedrock ceiling, 1.0-point lines for continuous floor, and 0.5-point lines for the floor detail (figure 5). I also add floor detail to the sections using macros. After I have drawn the cross-section, I group all of the parts of the section together into one object to make it easier to arrange the pieces in the final drawing.

T Text Tool   **O** Circle Tool

Use the Text tool to place the ceiling heights on the cave map. Then use the Circle tool to draw the circle around the text. If you hold down the shift key while sizing the circle, Canvas will draw a perfect circle and not an ellipse. Once you have the text and circle drawn and centered on each other, group them into one object and place where you want it.

3.4 Text

Use the Text tool to place the text on your cave map. I usually use an Arial font for text that is part of the map, because it is easier to read than most of the other fonts. Be sure to include the entrance, name of the cave and general location (state, county), the dates of survey, the list of mappers, your name and copyright notice, and other details such as cave length and depth.

4.0 Drawing the Cave (Profile View)

Use the curve tool and macros to draw the profile. If you are drawing the profile in the same space as the plan view. Put the bedrock features (ceiling, etc.) on the *Walls* layer and put the other information on the *Details* layer. I use the same pen weighting scheme as I do for the cross-sections. Put any text you want on the profile onto the Text layer.

5.0 Assembling the Final Map

5.1 Technical details

For the final map, you will need to add a north arrow and scalebars for both the plan view and the profile. You will also need to create an explanation for all of the symbols you have used on your map. I find it easiest to make a master explanation on a separate drawing with all of the common cave symbols. I then place a copy of the explanation into my current map and remove all of the symbols that I didn't use.

5.2 Moving things around

Once you have all of the pieces of your map in the drawing area, you will probably want to rearrange things to make the layout look better to win Medal at the annual NSS Cartographic Salon. Moving things is fairly easy, but you have to be careful about how you group objects to move them. There are two basic ways of moving things around without messing up your map.

On the **File** pulldown menu, select **Preferences** and check the box that reads "Select Across Visible Layers." With this box checked, you can select the whole plan map and then move it. At this point, you have to be very careful about how you grab the selected objects with the mouse. If you click wrong, you will move only one piece of the map and will have to madly scramble up to the undo button. Another way is to group the plan (or profile) together before moving it.

First, on the plan map, select all of the items on the *Walls* layer and group them together. Repeat this with all of the layers on your plan map. Now repeat this process on all of the layers of your profile map. Doing this will allow you to put your drawing objects back on the right layers later.

Make sure you have "Select Across Visible Layers" checked in you preferences. Now you can group all of your grouped layers together on the plan map (or profile). Keep in mind, that when you do this, all of the groups will be brought to the active layer. Now select all of your grouped layers by dragging a selection box around them. Group these together and now your plan map is one object that you can move around. Repeat the process for your profile map. Shift stuff around and win that medal.