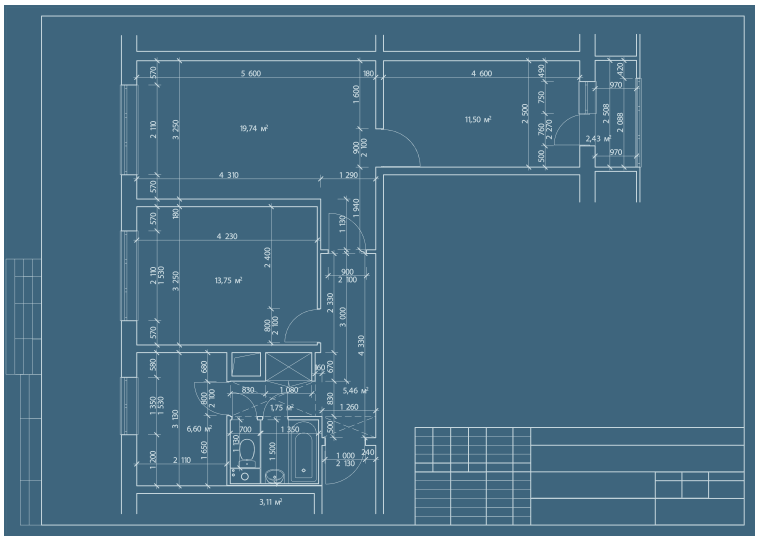
Viewport Creation: Paper Space

AT ONE TIME all notes, dimensions, labels, and drawing border and title block were created in model space along with the drawing. With the creation of paper space, AutoCAD users had access to a space designed for layouts and scaling. Today drawings are often created in model space and the border and title block and the viewports, etc. are placed in paper space.



Objective:

Create, setup, and print viewports in paper space.

Key Terms:

border and title block
context sensitive menu
docked viewport
floating viewport
hard clip limits
layout
model space (MSPACE)
mview
paper space (PSPACE)
revision cloud
revision table
scale
scale factor (SF)
viewport

Use Viewports in Paper Space

Paper space (PSPACE) is a piece of electronic paper. In paper space a drafter can paste different views of drawings created in model space and prepare those drawings for printing. Paper space drawings are accessible from, and are held in, the layout area where docked or floating viewports are created. Viewports can be thought of as holes in the sheet of paper that allows the user to see into model space where the drawing geometry resides. **Model space (MSPACE)** is a limitless drawing environment where drawing geometry is created. The user can create an unlimited number of drawings in model space and decide which ones will be viewed in paper space.

USE VIEWPORTS IN PAPER SPACE

Drawing elements that traditionally reside in paper space include:

- A **viewport** is a geometry object that creates an electronic hole in the electronic sheet of paper residing in layout to view geometry in model space. Users can create, scale, and place viewports in an area called 'layout' that is displayed by clicking on the 'layout tab.' Viewports allow the user to add borders, title blocks, company logos, company names, notes, tables, schedules, dimensions, etc. Viewports can be docked or floating.
  - A **floating viewport** is an object created in paper space that displays model space views and can be given varying non-rectangular sizes and shapes. By typing the mview command at the command prompt, floating viewports are created.
  - A **docked viewport** is an object created in paper space that displays model space views and is typically uniform in size and shape. By typing the 'mview command' at the command prompt, docked viewports are created.
- The **border and title block** are geometry created to house the graphic objects of a drawing and can contain the following information about the model:
  - Company name
  - Scale or scale factor, tolerances
  - Date
  - Drafter's name
  - Other design information
- Individual drawing titles are names given to individual viewports.
- **Scale** is a setting that modifies the size of an existing object. It is the process of enlarging or reducing those objects to fit properly on a sheet of paper. It is the relationship between the paper printed units and the electronic drawing units (e.g., ¼ inch = 1 foot).
- **Scale factor (SF)** is the numerical difference between the paper printed units and the electronic drawing units (e.g., 1:48). A printed drawing is usually smaller than the object's actual size. Hence, an operator must understand and implement the scale factor in

FIGURE 1. These model cars are an example of scale factor. From left to right with a 12-inch ruler as a scale: Matchbox Chevrolet Tahoe (1:64), Ford F-100 (1:43), Revell Monogram 1999 Ford Mustang Cobra (1:25), and 1987 Ferrari (1:18). (Image courtesy Wikipedia at https://en.wikipedia.org/wiki/File:ScaleCarComparison.jpg)

order to display an accurate representation of the size of text, dimensions, mleaders, and tables, etc. When setting up basic values, that ensure drawings adhere to CADD standards, calculating the scale factor is essential.

- A **revision cloud** is geometry used to draw attention to changes in a drawing.
- A **revision table** is an area of the border and title block that contains information about the changes the viewer is seeing, often including a date.

Mview Commands

Mview is a command that creates and controls layout viewports. The user can create a viewport by typing 'mview' at the command prompt. The 'mview command' has the following options.

- ON: This mview option makes a selected layout viewport active. An active layout viewport displays objects in model space. Drafters can create as many layout viewports as they want, with a maximum of 64 layout viewports can be active at one time.
- OFF: This mview option makes a selected layout viewport inactive. Objects in model space are not displayed in an inactive layout viewport.
- FIT: This mview option creates a single layout viewport that occupies the layout to the edges of the printable area. When the paper background and printable area are turned off, the layout viewport fills the display.
- SHADEPLOT: This mview option specifies the visual style to be used when plotting a selected layout viewport. The 'As Displayed Option' specifies that the layout viewport be plotted using the same visual style as displayed.
- LOCK: This mview option prevents the 'zoom scale factor' from being changed in the current layout viewport when working in model space.
- NEW: This mview option creates and places a layout viewport on the layout. With this option, the drawing area switches temporarily to a maximized view of model space, where the drafter can click two points to define the rectangular area of the view.
- NAMED: This mview option inserts a 'named view' that was previously saved in model space together with a new layout viewport onto the current layout.
- OBJECT: This mview option specifies a closed polyline, ellipse, spline, region, or circle to be converted into a layout viewport. If a drafter selects a polyline, it must be closed and must contain at least three vertices. It can contain arc segments as well as line segments.
- POLYGONAL: This mview option creates an irregularly shaped layout viewport using specified points. The options available are similar to those in the 'pline' command.
- RESTORE: This mview option reestablishes viewport configurations saved with the VPORTS command.
- LAYER: This mview option resets the 'layer property overrides' for the selected layout viewport to the global layer properties.

SETUP VIEWPORTS IN PAPERSPACE

A viewport is a geometry object that creates an electronic hole in an electronic sheet of paper that resides in layout in order to view geometry in model space.

Layout

Layout is a tab that permits paper space viewports to be created with scaled insertions of the model space drawing. The layout tab icon provides access to an area called 'layout.' Each layout stores its own page setup that controls the appearance and format for displaying and printing/plotting each layout. Drafters can access one or more layouts from the tabs located at the bottom-left corner of the drawing area to the right of the model tab. Multiple layout tabs can be used to display details of the various components of a drawing at several scales and on different sheet sizes. There are several ways to add new layouts or copy existing layouts including:

- Using the 'layout command' at the command prompt.
- Right-clicking on an existing layout tab.
- Using the 'layout wizard.' To access the 'layout wizard' the drafter would type 'layoutwizard' at the command prompt.
- Using the 'designcenter' by pressing the control button and then the #2 key.

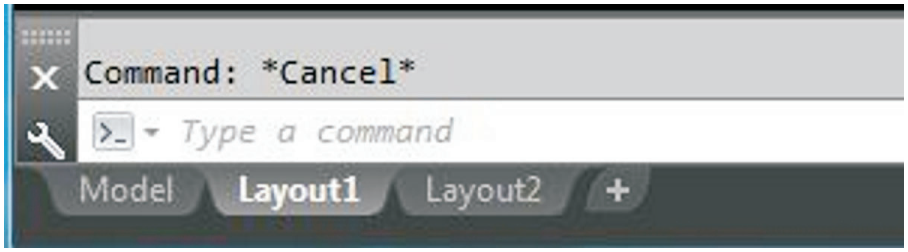


FIGURE 2. AutoCAD's two layout tabs, that give users access to paper space are shown here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

Designcenter

Using the 'designcenter' to create a layout or copy an existing layout is accomplished as follows:

STEP 1: Click on 'layout1.' This action causes AutoCAD to switch from model space to paper space. An existing paper space viewport will be found in the layout area. Before creating a new viewport(s), the user must delete the existing paper space viewport. The existing viewport is the solid-line rectangle inside of the dashed-line rectangle. Then, the drafter selects the 'erase icon,' clicks on the viewport, and hits 'enter.' AutoCAD defaults to a white sheet of

electronic paper. Many users find this color to be undesirable to look at long term, and often change the color to black.

STEP 2: The 'options dialog box' pops up. Then, the drafter clicks on the 'colors button' to open the colors options.

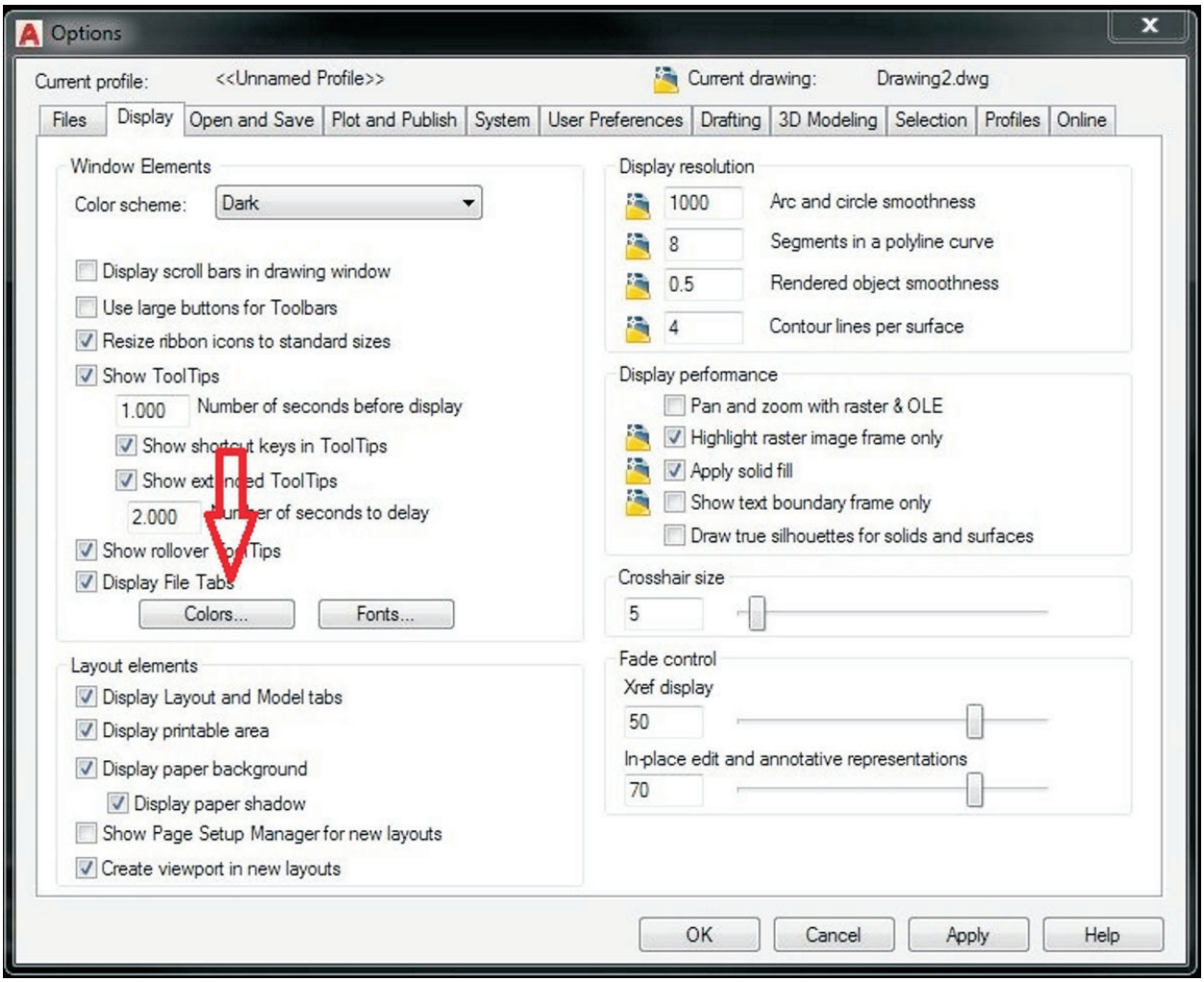


FIGURE 3. AutoCAD's options dialog box is shown here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

STEP 3: Next, the 'drawing window dialog box' appears and the drafter:

- Sets the context category to 'sheet/layout'
- Sets the interface element category to 'uniform background'
- Sets the color category to 'black'
- Clicks the OK button. This action turns the electronic sheet of paper to black.

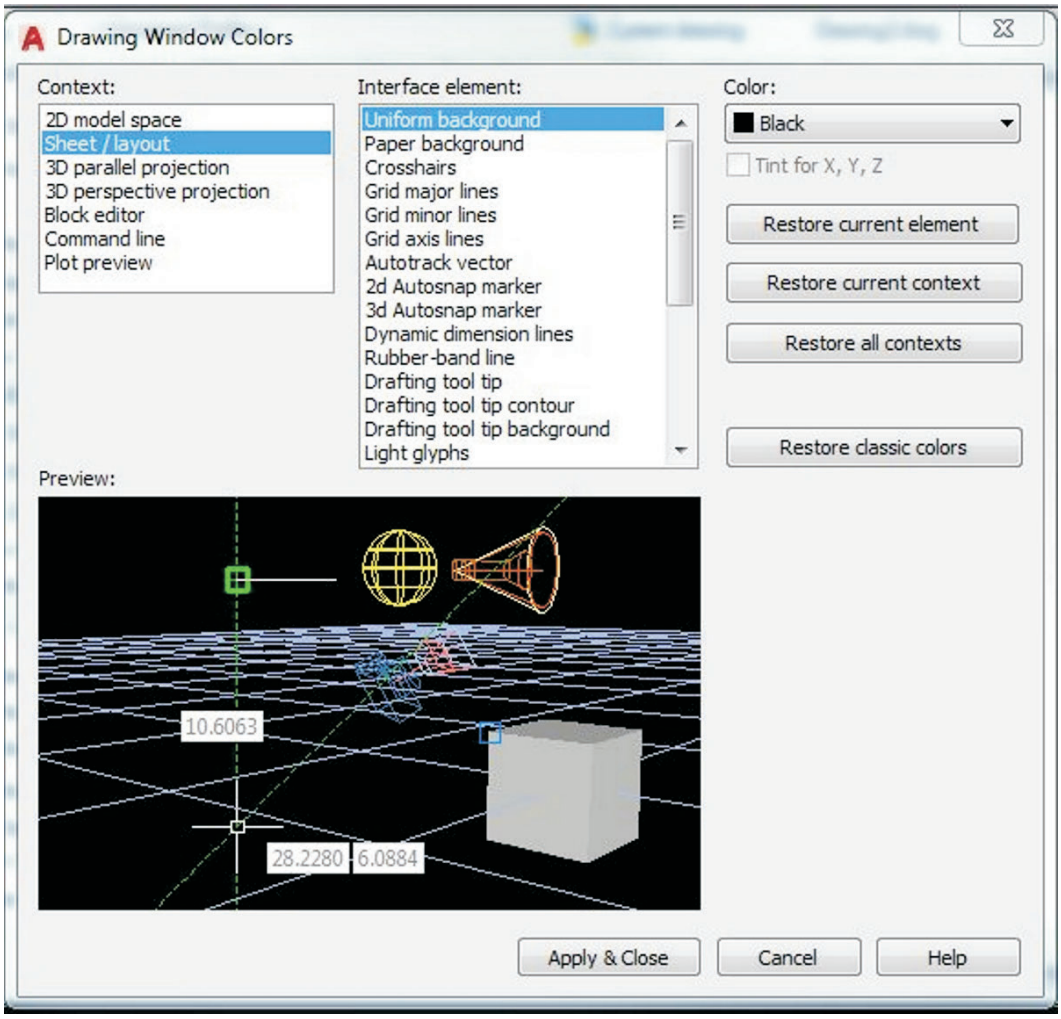


FIGURE 4. AutoCAD's drawing window colors dialog box is shown here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

Creating a Viewport

Creating a viewport is accomplished in a couple of ways: by creating a new viewport or by turning an existing object into a viewport. The drafter begins by drawing borders and title blocks. To begin, a drafter creates an individual border and title block drawing on the electronic sheet of paper in the layout area or import an existing border and title block drawing into the electronic sheet of paper in the layout area.

To accomplish this task the drafter types the 'insert command' at the command prompt and locates the border and title block drawing. Next, a border and title block is inserted: one previously drawn or the TBAL-MS drawing used in the tutorial video. [NOTE: Download the TBAL-MS drawing, by going to https://rchsit.weebly.com/uploads/4/7/2/5/47258805/vm-l_tbal-ms.dwg.] Then, the drafter:

1. Types 'insert' at the command prompt.
2. Browses to the existing drawing or the downloaded TBAL-MS drawing.

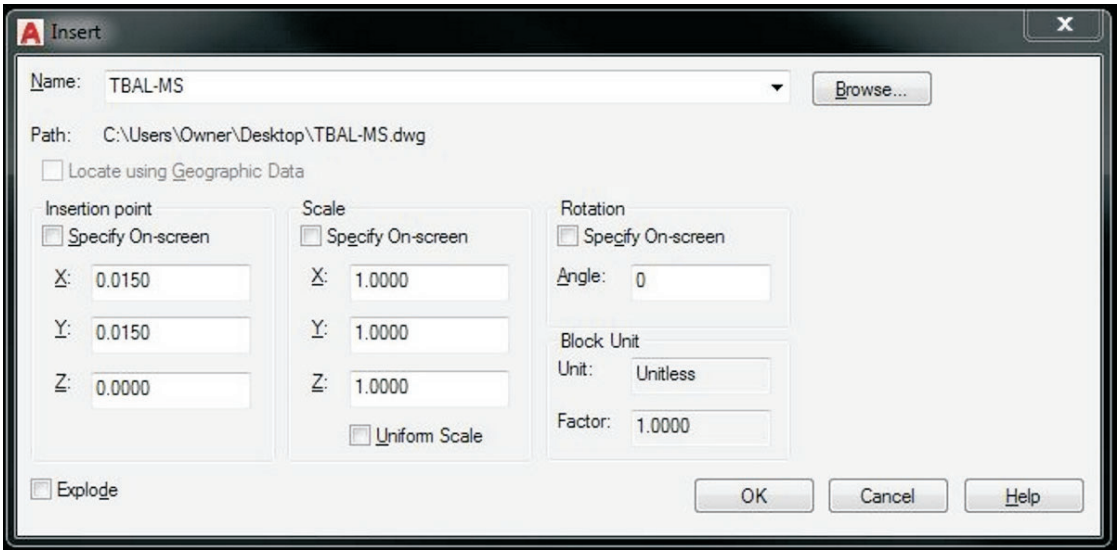


FIGURE 5. AutoCAD's insert dialog box is shown here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

3. Unchecks all 'pick boxes' and enter 0.015 in the x-axis box and 0.015 in the y-axis box. This action inserts the TBAL-MS border and title block drawing with the 'hard click limits' in mind. Then, clicks the OK button. This action places the TBAL-MS drawing onto the electronic sheet of paper. **Hard clip limits** are the built-in margins beyond which the printer will not print. These limits vary from printer to printer. It is important to know the printer's 'hard clip limits' in order to create the appropriate size geometry and to place that geometry in the correct x- and y-position on the layout sheet.

   a. Find the 'hard clip limits' inside the print/plot dialog box. Open the dialog box,

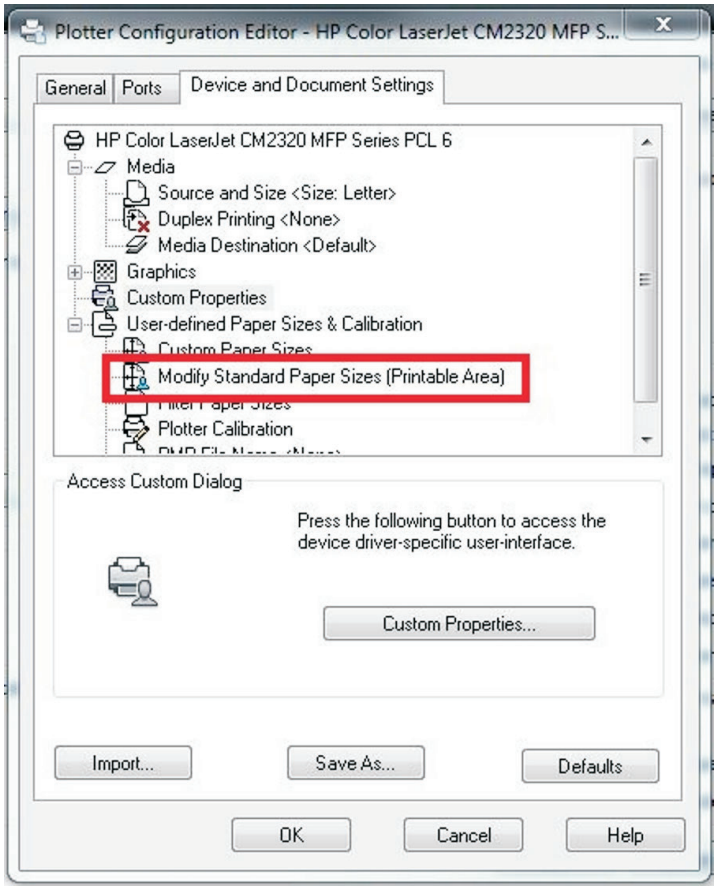


FIGURE 6. AutoCAD's 'modify standard paper size (printable area) option' in the plotter configuration editor is depicted here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

select the printer, and click on the 'properties button' to the right of the selected printer area.

b. The 'plotter configuration editor dialog box' pops up. Click on 'modify standard paper sizes (printable area) option text.' This action displays the 'hard clip limits' of the printer using an A-size sheet of paper (8.5 × 11 inches). Close out the 'plot configuration editor' and the 'plot dialog box' and return to the layout area.

4. Ensure the viewport layer is broadcasting. If non-existent, create a layer called 'viewport;' assign the color 'cyan' to the layer, to ensure the viewport layer broadcasts.

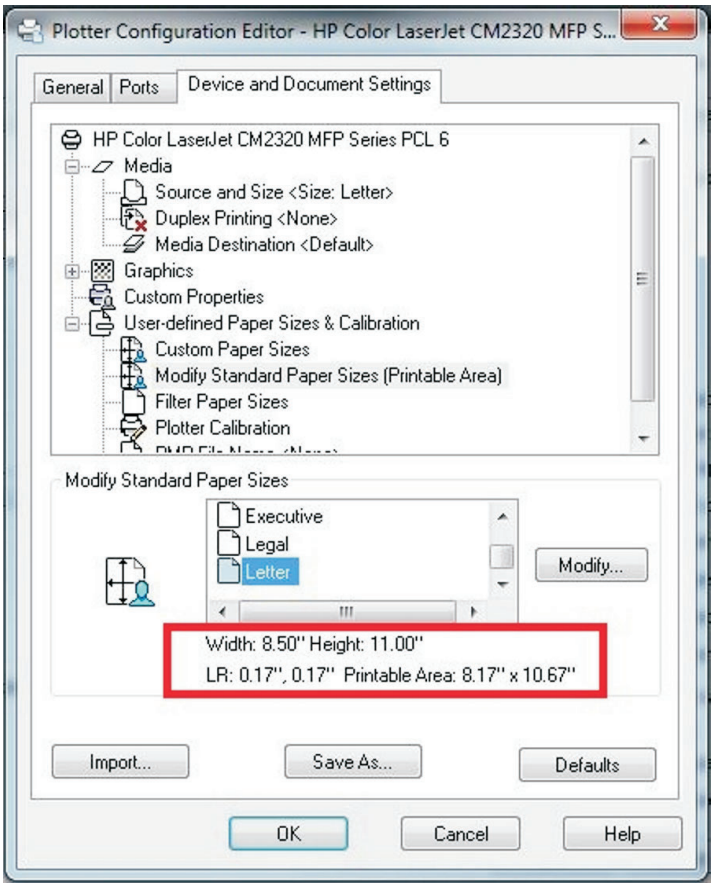
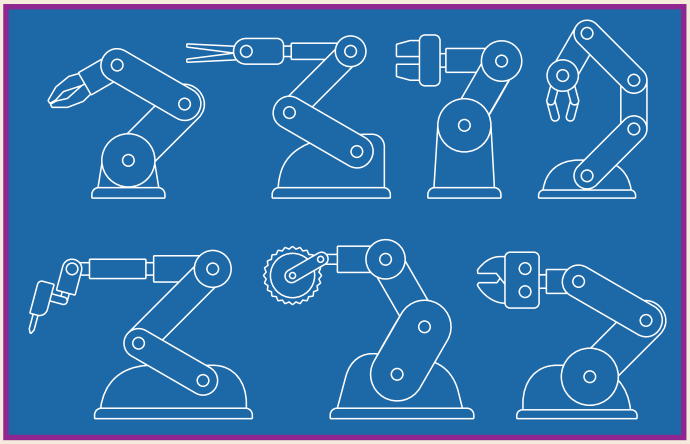


FIGURE 7. The image shows AutoCAD's hard clip limits for a printer using an A-size sheet of paper is shown here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

FURTHER EXPLORATION...

ONLINE CONNECTION: The Future of Making Things

Modbot is an industrial robot. Robots for manufacturing processes are usually expensive and intricate. Watch the 3-minute video, "The Future of Making Things" at https://www.autodesk.com/customer-stories/modbot-video. The Modbot (modular robot) group has worked with Siemens, Boeing, and other companies. Autodesk's CAD/CAM product, "Fusion 360" helps Modbot create smart hardware and software. Modbot robots are assembled from plug-and-play pieces that fit together easily and can be configured as needed.



Modbot is a product designed in a modular format, to assist with making quick changes to a process. Industrial robots also conduct dirty and dangerous work.

5. Mview allows the user to create viewports. To create a viewport, the drafter would follow these steps:

   a. STEP 1: Type 'mview' at the command prompt. If using the downloaded TBAL-MS, select the 'polygonal option' and select all the inside corners of the border and title block drawing.

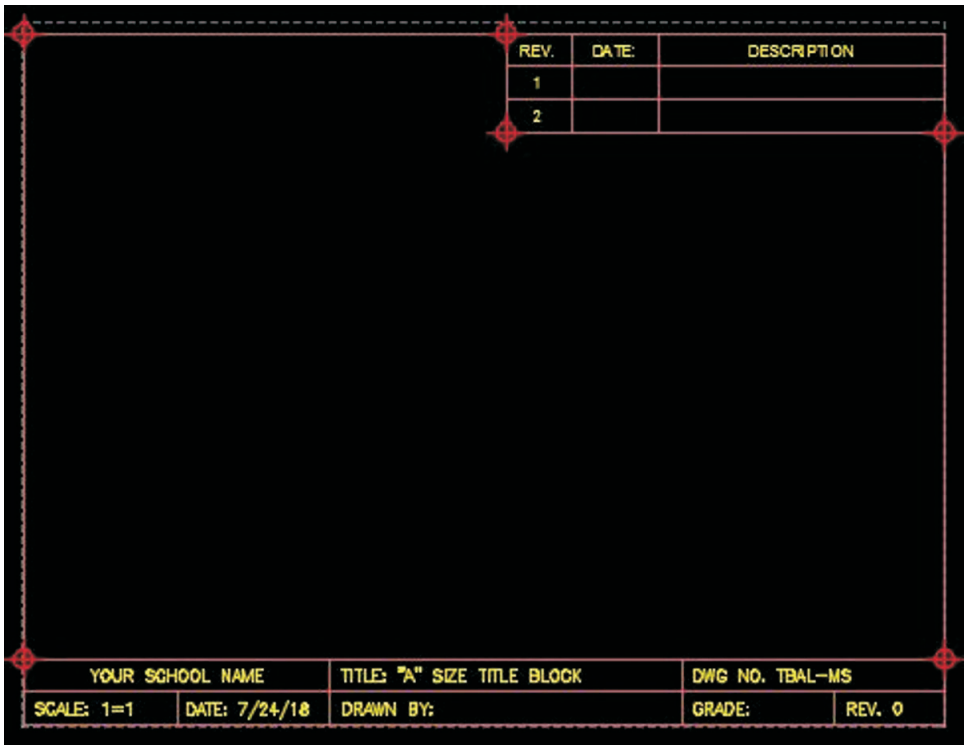


FIGURE 8. The image shows the pick points to create a polygonal viewport in AutoCAD. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

   There are six 'pick points.' After picking the sixth pick point, type the letter "c" and hit 'enter;' do not click on the starting pick point. This action closes the cyan colored viewport on top of the border and title block drawing.

   b. STEP 2: Go back to model space by clicking on the model tab at the bottom left of the screen, and then create a circle and a rectangle.

   c. STEP 3: Go to paper space, by clicking on the layout tab that was activated, and create the viewport.

   d. STEP 4: Double-click inside the viewport to activate model space (while in the layout tab environment). Then, the viewport highlights in a bold cyan color.

   e. STEP 5: Type Z (for 'zoom') at the command prompt and hit 'enter.' Type A (for the 'all option') in the zoom command and hit 'enter.' This action brings the circle and the rectangle into view.

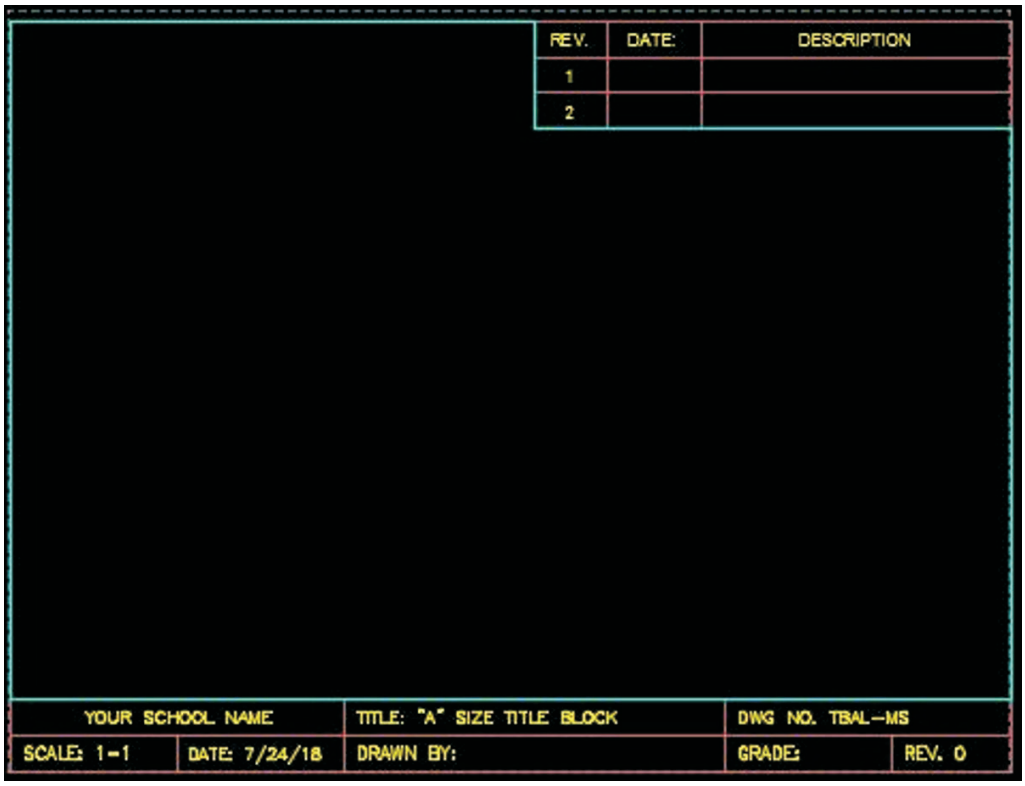


FIGURE 9. The image shows the polygonal viewport in AutoCAD. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

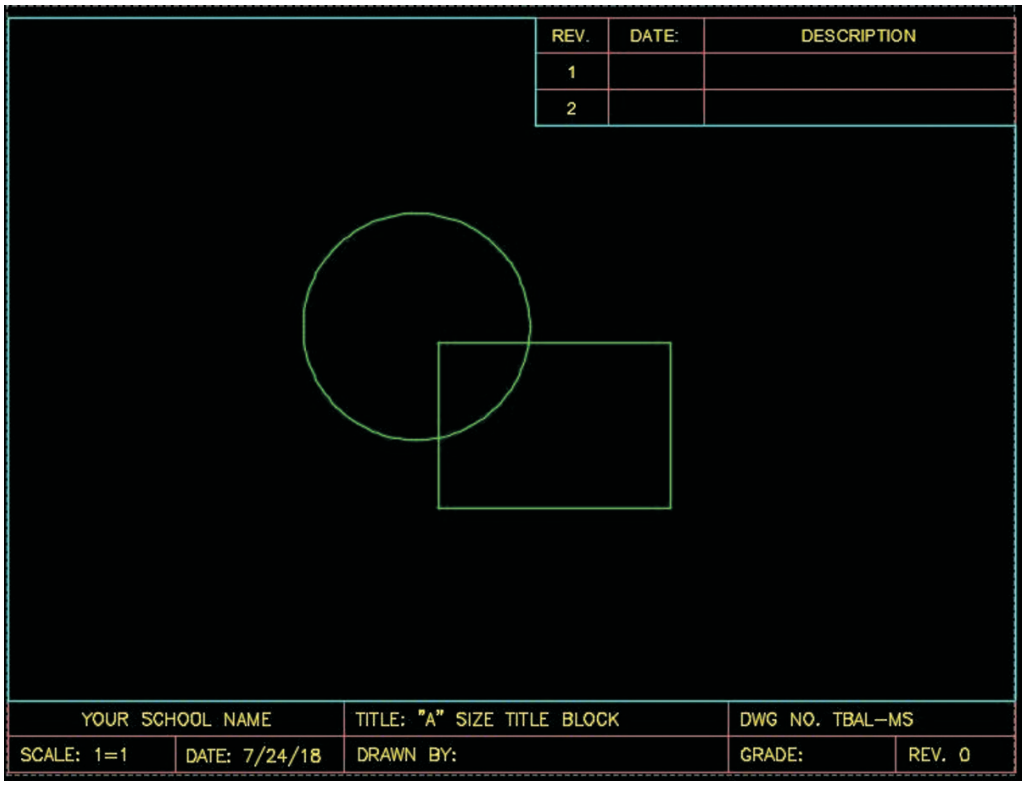


FIGURE 10. AutoCAD's polygonal viewport is pictured here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

f. STEP 6: Double-click inside the viewport to cause the viewport to 'bold' and provide user access to model space through the hole in paper space's electronic sheet of paper. Return to paper space by double-clicking anywhere outside of the bold viewport. Then, the viewport will return to a 'non-bold state' that is now in paper space.

FIGURE 11. AutoCAD's polygonal viewport with model space activated is pictured here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

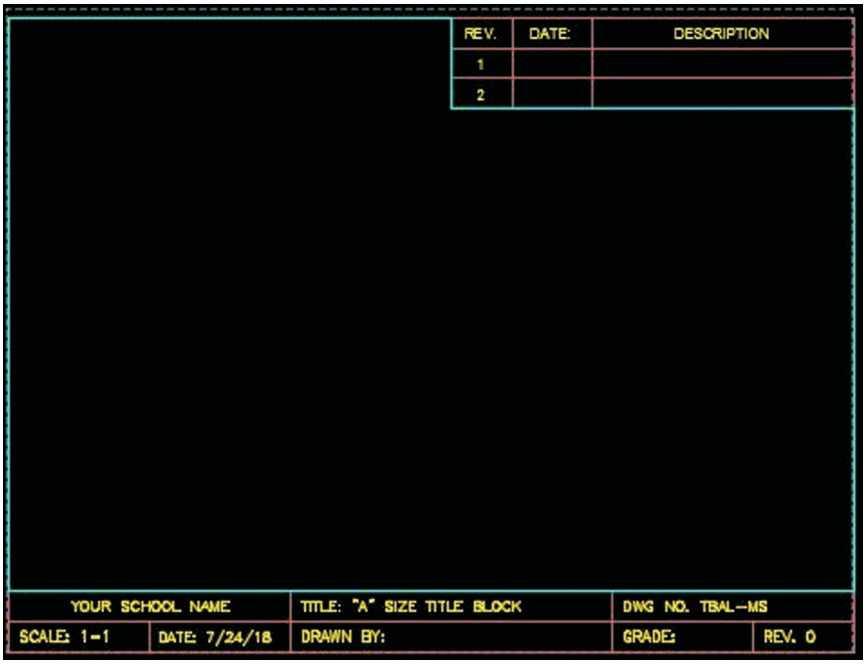


FIGURE 12. AutoCAD's polygonal viewport has returned to a non-bold state in this image. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

g. STEP 7: Go to layout tab #1 and right-click on the tab. This action brings up a context sensitive menu. A **context sensitive menu** is a list of options based on the most recent command. Select the 'rename' option and name layout tab #1 as 'TBAL-PS.'

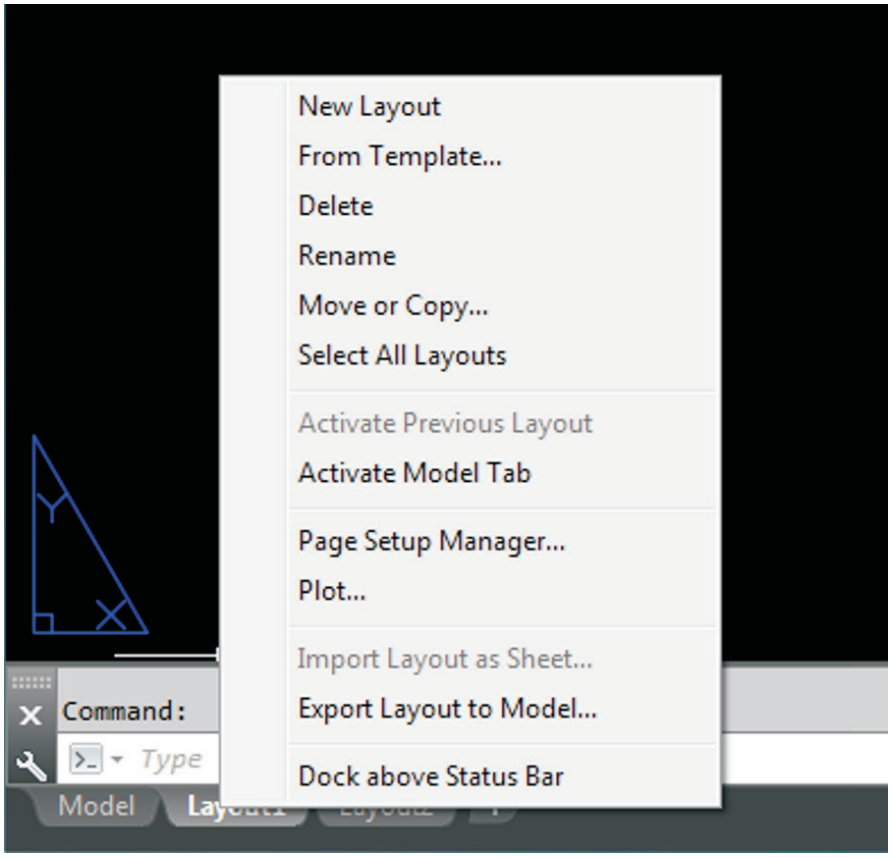


FIGURE 13. AutoCAD's context sensitive menu with the rename option is pictured here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

h. STEP 8: Select the 'rename' option and then name layout tab #1 as 'TBAL-PS.'

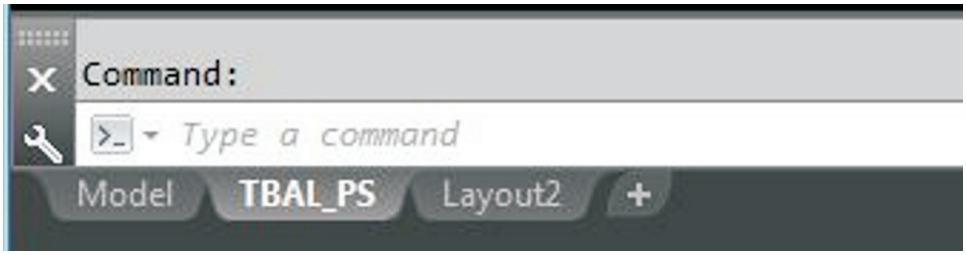


FIGURE 14. AutoCAD's context sensitive menu with the 'rename' option is pictured here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

Printing From Paper Space

Then, the drafter would conduct the following steps to print from paper space:

STEP 1: Right-click on the 'TBAL-PS layout tab' and select 'page setup manager.'

STEP 2: Then, the 'page setup manager dialog box' displays all layout tabs in the page setups area. Select 'TBAL-PS' and then select the 'modify' button.

STEP 3: The 'page setup TBAL-PS dialog box' opens to the 'print/plot set up page.' (This is the same page as when you access the print/plot icon.) Then:

- Select the correct printer.

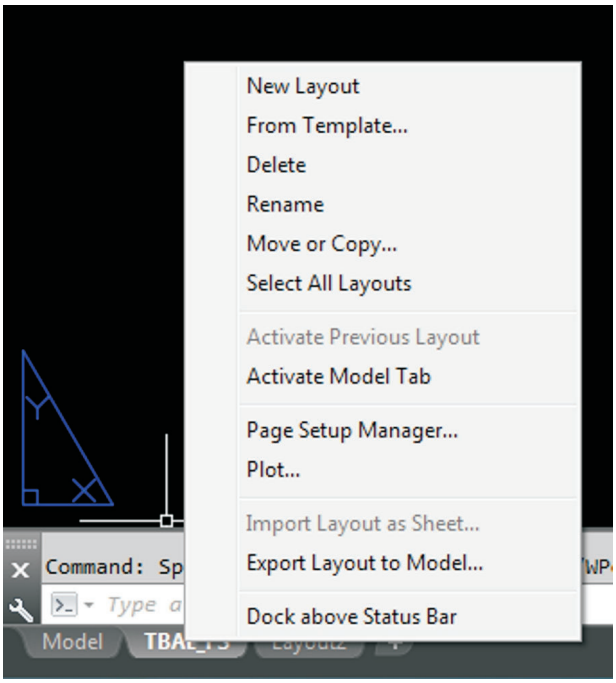


FIGURE 15. AutoCAD's context sensitive menu with the 'page setup manager option' is illustrated here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

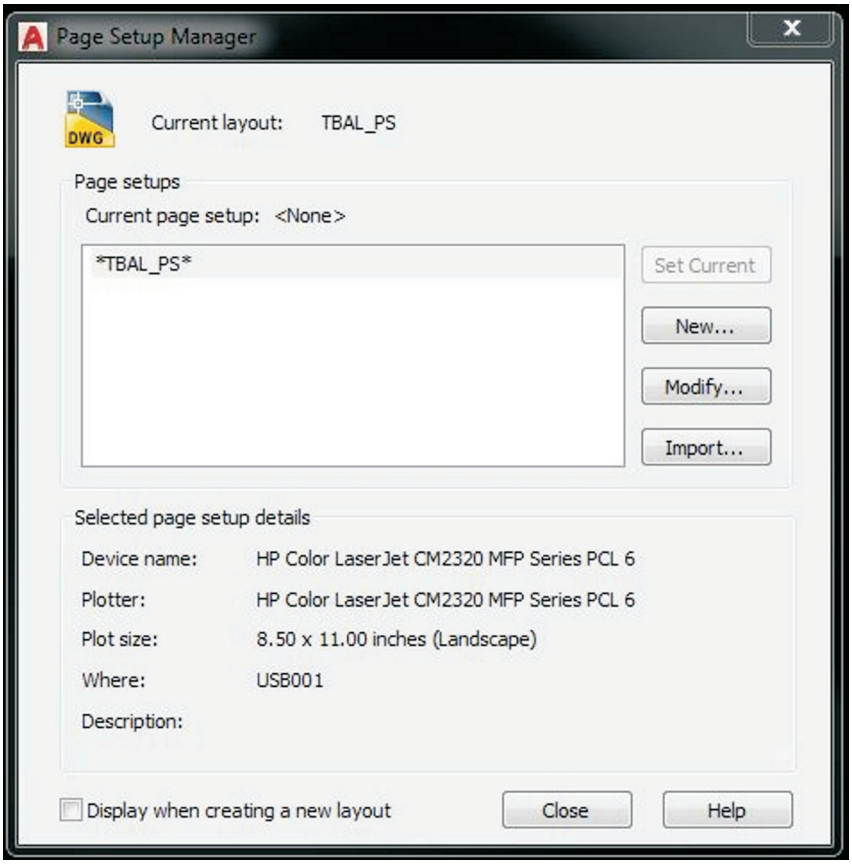


FIGURE 16. AutoCAD's 'page setup manager dialog box' is shown here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

- Select the paper size. (Here the letter size has been selected.)
- Select the correct plot area. (Here the layout option has been selected.)
- Set 'plot offset' x and y to zero.
- Leave 'plot scale' and 'center the plot' unchecked.
- Leave 'scale' at 1:1. [NOTE: All scaling is conducted in the viewport when printing/plotting from paper space.]
- Setup the right side of dialog box. [See FIGURE 16.]
- Select the 'preview button' to verify settings are correct.
- Select the OK button to return to 'page setup manager. [See FIGURE 16.]
- Select the 'close' button to return to the layout area. The 'layout tab page setup manager' is now set up to print. Unless the user changes a setting, this layout tab can be printed without selecting the preview button. [NOTE: This is how companies can work all day to setup CAD to print hundreds of drawings, turn the lights out, and go home while the printer/plotter does its work.
- Save the drawing and give the drawing a name that signifies it is a template for paper space printing, such as 'TBAL-PS.'

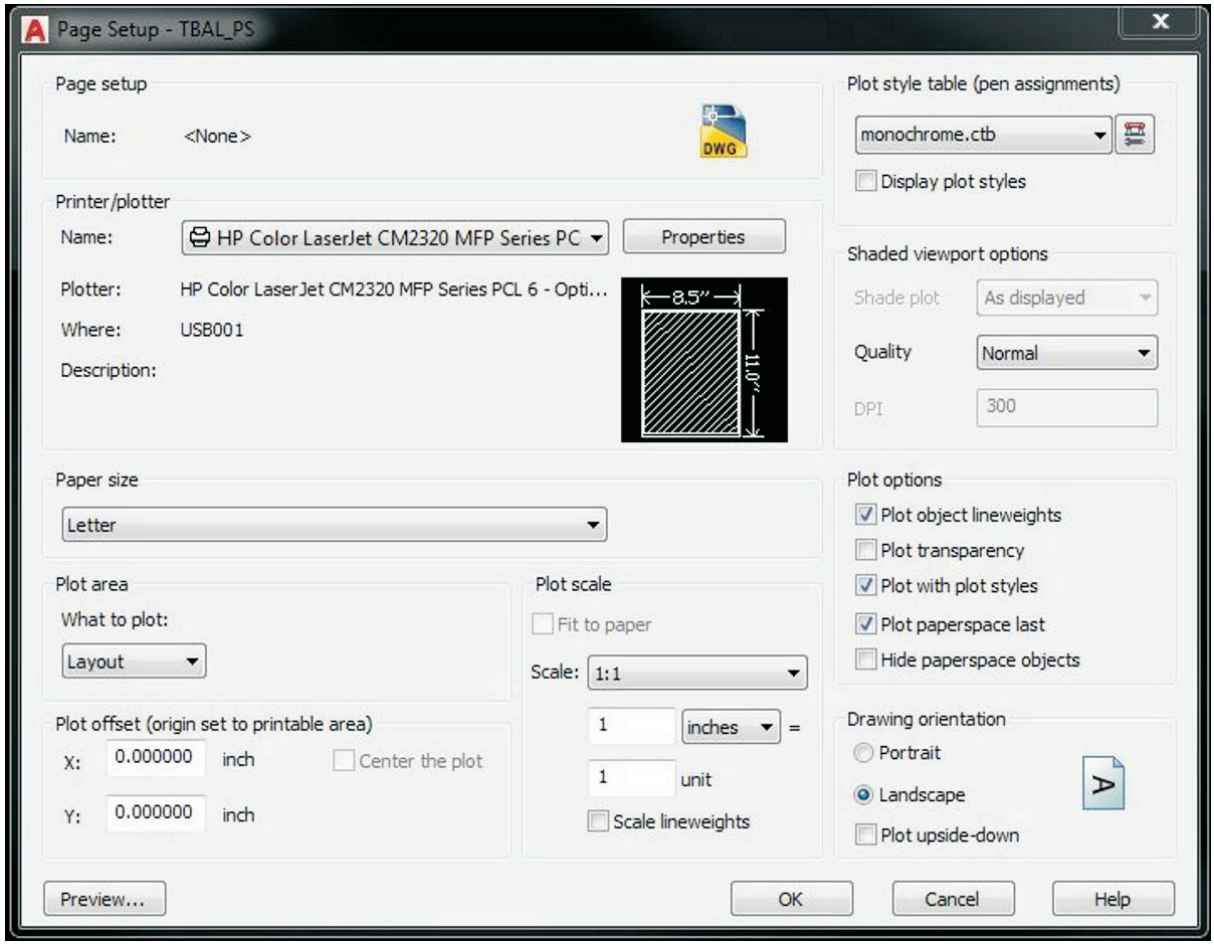


FIGURE 17. AutoCAD's 'page setup-TBAL-PS dialog box' is pictured here. (AutoCAD screen shot reprinted with the permission of Autodesk, Inc.)

Summary:

At one time all notes, dimensions, labels, and drawing border and title block were created in model space along with the drawing. With the creation of paper space, AutoCAD users had access to a space designed for layouts and scaling. Today drawings are often created in model space and the border and title block and the viewports, etc. are placed in paper space.

Checking Your Knowledge:

1. Differentiate between model space and paper space.
2. Describe a viewport. Then, differentiate between a floating viewport and a docked viewport.
3. Mview is a command that creates and controls layout viewports. List and briefly describe six (6) mview options.
4. Describe the features of an AutoCAD 'layout.'
5. In what ways does paper space streamline a company's work?

Expanding Your Knowledge:

Watch the "Paper Space in AutoCAD" video at https://video.search.yahoo.com/yhs/search?fr=yhs-Lkry-SF01&hsimp=yhs-SF01&hspart=Lkry&p=paper+space+Autocad+video#id=3&vid=4b99abb9eb14bbd2031e88d3613f34af&action=click. Then, practice moving the drawings you have created in model space to paper space. Use the Web Links for added input about model space and paper space.

Web Links:

AutoCAD Setting Up Paper Space

https://www.youtube.com/watch?v=kv32d0QGDc0

Commands for Model Space and Paper Space

https://knowledge.autodesk.com/support/autocad-lt/learn-explore/caas/CloudHelp/cloudhelp/2018/ENU/AutoCAD-LT/files/GUID-C0465010-3499-4D9D-B330-B9571C58790D-htm.html