

# Chapter 3

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## Using Basic Tools and Coordinate Systems



### Learning Objectives

**In this chapter, you will learn to:**

- Use basic tools for mapping
- Use coordinate systems
- Modify the settings and alignment of the UCS triad
- Define and modify coordinate systems
- Assign coordinate system to drawings and datasets



## INTRODUCTION

In this chapter, you will learn about the basic tools used for sketching a drawing and analyzing the geospatial data. Also, you will learn about coordinate systems. Moreover, this chapter explains some basic operations such as zooming, viewing, drawing, scaling and snapping and so on that are used for the generation of data. This chapter also discusses the drawing of a sketch in different sketching modes such as Grid and Ortho.

In this chapter, you will learn about the use of a coordinate system for drawings. After reading this chapter, you will learn how to align the User Coordinate System (UCS) and World Coordinate System (WCS) for drawings, and also how to align the UCS triad with any model or along the X, Y, and Z axes.

The basic tools such as **Zoom**, **Pan**, **Snap**, and so on, are frequently used while creating, editing, and analyzing the map data. Moreover, these tools help to increase the mapping accuracy by providing more flexible views while working in a sketching mode. These tools and their functions are discussed briefly in the forthcoming sections.

## USING THE BASIC TOOLS

The basic tools are used frequently in the mapping process. These tools are often used for displaying drawing at required scale, while generating the drawing data. Some of the basic tools used in drawing are discussed next.

### Using the Zoom Tool

<b>Ribbon:</b>	View > Navigate > Zoom
<b>Command:</b>	ZOOM or Z

In GIS, it is very important to check the minute details of the data displayed and alter it, if necessary, for the purpose of interpretation, analysis, and mapping. In AutoCAD Map 3D 2011, you can view the required portion of a drawing and then perform the required modification. You can use the **Zoom** tool to view a particular section of the map and then change the attributes, as per your requirement.

The **Zoom** tool is used to enlarge or reduce the view of a drawing without affecting the actual size of entities. To use different zoom tools in the drawing process, select the down-arrow next to the **Extents** option in the **Navigate** panel of the **View** tab; all options of the **Zoom** tool will be displayed in the drop-down list, as shown in Figure 3-1. After invoking the **Zoom** tool, you can select the required zoom option from the drop-down list to enlarge or reduce the view of the specific part of the map. Some of the important zoom options are discussed next.



**Tip:** To invoke the **Zoom** tool from the Menu Bar, left-click on the down-arrow in the Quick Access Toolbar; a drop-down list is displayed. In this drop-down list, select the **Show Menu Bar** option; the Menu Bar will be displayed. Next, choose the **View** tab from the Menu Bar, and then select the required option from it.

## Extents



The **Extents** zooming option is used to display drawing extents in the current drawing file. To do so, select the required map data in the Drawing Window, and then choose the **Extents** tool in **Navigate** the panel from the **View** tab; the selected data will get enlarged.



### Note

The **Extents** zooming option can be applied to the layer data in the **Task Pane**. To do so, right-click on the selected layer; a shortcut menu will be displayed. In this shortcut menu, choose the **Zoom to Extents** option.

## Realtime



The **Realtime** zooming option is used to zoom in and zoom out of a drawing interactively by using the left mouse button. Choose the **Realtime** option, choose **View > Navigate > Extents** drop-down; the **Realtime** zooming option will be invoked. Next, press and hold the left mouse button and then drag the cursor up or down to zoom in or zoom out of the drawing. To exit the **Realtime** zooming mode, right-click in the Drawing Window; a shortcut menu will be displayed. In this shortcut menu, choose the **Exit** option. You can also press ESC or ENTER to exit the mode.



**Tip:** You can also use the mouse wheel to zoom in or out of the drawing.

## Window



This is the most commonly used option of the **Zoom** tool. Using this option, you can specify the area you want to zoom in by specifying two opposite corners of the rectangular area. You can specify the two corner points of the rectangular area by clicking the left mouse button or by entering the coordinates of the first and opposite corners in the **Command Line**. On doing so, the center of the specified area (window) becomes the center of the new display screen. When you use this zoom tool, the area inside the window gets magnified and fills the Drawing Window.

## Previous

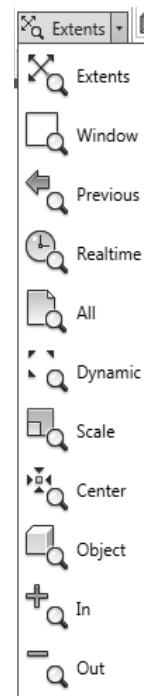


While working on a complex drawing, you may need to zoom in on a portion of the drawing to edit some minute details of the drawing object. After you have completed the editing, you may want to return to the previous view. This can be done by using the **Previous** option. AutoCAD remembers the last ten views, and these views can be restored by using the **Previous** option.

## All



This option is used to zoom the drawing limits or the extents of the entire drawing, whichever is greater. Whenever you increase the limits, the current display is not



**Figure 3-1** Various options for zooming

affected and hence it is not displayed. You need to use the **All** option to display the limits of the drawing. Sometimes it is possible that the objects are drawn beyond the limits. In such a case, the **All** option zooms to fill the drawn objects in the drawing area, irrespective of their limits.

## Object



While working with drawings containing several objects, you can use the **Object** zooming option to magnify or enlarge the required object/s. When you select the **Object** option from the zooming options drop-down list, the cursor turns into a selection box. By using this selection box, you can zoom object/s in the current drawing. To do so, select the desired object/s by using the selection box and then press ENTER; the selected object/s will be magnified to the limits of the Drawing Window.

## Using the Pan Tool

**Ribbon:** View > Navigate > Pan  
**Command:** PAN



You can use the **Pan** tool to pan a drawing interactively. This means you can pan a drawing by sliding it, and then placing it at the required position. To slide a drawing, choose the **Pan** tool from the **Navigate** panel; a hand symbol, indicating that you are in the pan mode, will appear in the Drawing Window. Place the symbol over the required drawing, and then press and hold it. Now, you can drag the hand to the required place on the screen to move the drawing. To exit the realtime pan, right-click to display a shortcut menu, and then choose **Exit** from it. You can also press the ESC or ENTER key to exit the pan mode.

## Using the View Scale Tool

**Status Bar:** View Scale

The **View Scale** tool in the Status Bar is used to fix the scale of a layer or a view. You can read the details of a drawing object accurately by altering the magnification scale of the current drawing proportionately. The **View Scale** tool is also used to edit the scale for zooming. The process of applying appropriate scale to a view and a drawing is discussed next.

To view the selected feature layer or raster layer at a certain fixed scale, double-click on the number button on the right of the **View Scale** tool in the Status Bar; a pop-up menu will be displayed, as shown in Figure 3-2; the scale editing window will be displayed.

100

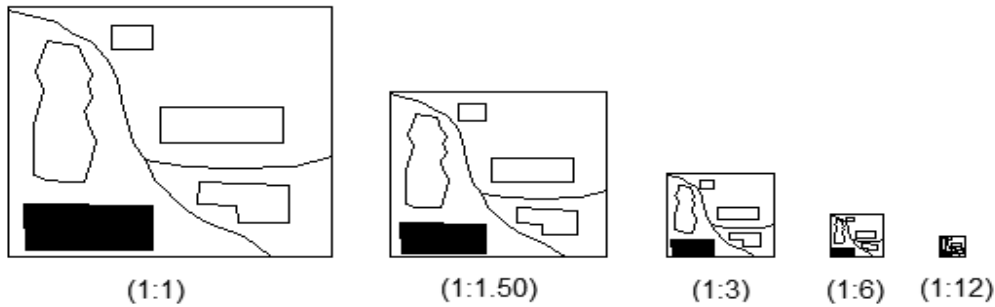
In the scale editing window, you can modify the scale of the drawing view. To do so, enter the required value in the **Enter scale value** edit box. Next, choose the **OK** button in this window; the drawing will be displayed at the modified scale value.



**Figure 3-2** The **View Scale** tool with the pop-up menu displayed and the **Custom** option chosen

If you increase the scale value by using the **View Scale** tool, the size of the drawing view

will be reduced in the Drawing Window, as shown in Figure 3-3. If you decrease the scale value by using this tool, the size of the drawing view in the Drawing Window will be magnified.



**Figure 3-3** The drawing view at incremental scale values



#### Note

1. On altering a drawing view by using the **Zoom** tool, the scale value in the **View Scale** tool will be altered, accordingly.

2. Any modification made in a drawing view by using the **View Scale** or **Zoom** tool will not affect the physical measurements of the drawing.

## USING THE SNAP AND GRID FUNCTIONS

You can use the snap and grid functions to track some of the known points, vertices, or nodes in the drawing. While you are in the drawing mode, you can use the snap function to track some of the known points in the drawing. Most of the snap functions used in the Modelspace are discussed next.

You can specify parameters for snapping and grid points distribution in the Drawing Window. You can also modify the grid measurements as per your requirement. To display grid points in the Drawing Window, choose the **Grid Display** button from the Status Bar; the grid points along the XY-plane will be displayed in the Drawing Window. To invoke the **Drafting Settings** dialog box, right-click on the **Grid Display** or **Snap Mode** button in the Status Bar; a shortcut menu will be displayed. Choose the **Settings** option from this shortcut menu; the **Drafting Settings** dialog box will be displayed, as shown in Figure 3-4. Setting the properties in the **Snap and Grid**, **Object Snap**, and **3D Object Snap** tabs in this dialog box are discussed next.



#### Note

If the grids are not displayed in the Drawing Window by default, invoke the **Zoom All** function by entering **Z** followed by **A** in the **Command Line**.

## The Snap and Grid Tab

In the **Drafting Settings** dialog box, choose the **Snap and Grid** tab, if it is not chosen by default; the snap and grid setting options will be displayed. In the **Snap and Grid** tab, the **Snap On** (**F9**) check box is clear by default. As a result, the crosshair can move freely in the Drawing

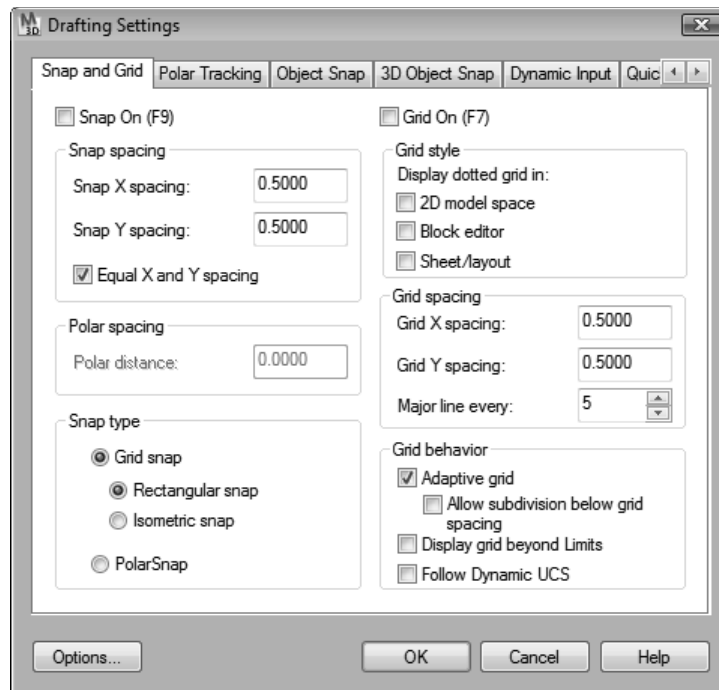


Figure 3-4 The **Drafting Settings** dialog box with the **Snap and Grid** tab chosen

Window. If you select the **Snap On (F9)** check box, the crosshair will trace grid points while the grid points are in the visible or hidden mode in the Drawing Window. The **Grid On (F7)** check box is also clear by default in this tab. As a result, the grid pattern will not displayed. If you select the **Grid On (F7)** check box, the grid pattern will be displayed in the Drawing Window. The different areas in this tab are discussed next.



**Tip:** You can display the grid lines in any 2D drawing space by choosing the **Grid Display** button in the Status Bar. Similarly, you can invoke the snapping mode by choosing the **Snap Mode** button in the Status Bar.

### Grid style Area

The options in the **Grid style** area are used to display the dotted grid pattern in the 2D model space, block editor, or the sheet or layout modeling space. You can select the **2D model space** check box, which is clear by default, to display the dotted grid pattern in the 2D drawing environment. Similarly, you can select the **Block editor** check box, which is clear by default, to display the dotted grid pattern while editing blocks.

### Grid spacing Area

The options in the **Grid spacing** area are used to adjust the spacing between grid points along the X and Y axes. To modify the spacing between grid points along the X axis, enter the required value in the **Grid X spacing** edit box. Similarly, to modify the spacing between grid points along the Y axis, enter the required value in the **Grid Y spacing** edit box. To modify the number of minor lines between two major lines, while working in the 3D sketching mode, enter a value in the **Major line every** edit box or set the value in the spinner located next to it.

### Grid behavior Area

The options in the **Grid behavior** area are used to modify the settings for the grid display. The **Adaptive grid** check box in this area is selected by default. As a result, the number of grid lines or grid line density between the major grid lines will be limited during zoom out. Select the **Allow subdivision below grid spacing** check box in the **Adaptive grid** option, if you want to display subdivision lines in the minor grid lines, while zooming in the drawing. To display grids beyond the limits of window, select the **Display grids beyond Limits** check box. To attach the grid plane to the current UCS, select the **Follow Dynamic UCS** check box.

### Snap spacing Area

The options in the **Snap spacing** area are used to set snap spacings in the grid mode. To modify the snapping distance between two snap points along the X-axis, enter the required value in the **Snap X spacing** edit box. Similarly, to set the snapping distance between two snap points along the Y-axis, enter the required value in the **Snap Y spacing** edit box. To set different snapping spaces between snap points along the X and Y axes, clear the **Equal X and Y spacing** check box. Various methods to customize the snap spacing are discussed next.

#### Snap to Grid

In the snap to grid mode, if you move the cursor in the XY-plane, the cursor will snap to the adjacent grid point, refer to (1) in Figure 3-5.

#### Snap to Spacing

In the snap to spacing mode, if you modify the snap spacing without changing the grid spacing, the cursor will snap to the grid point located at the modified snap spacing, refer to (2) in Figure 3-5.

#### Snap to Unequal X Spacing and Y Spacing

In the snap to unequal X spacing and Y spacing, if the snap spacings in the X axis and the Y axis are different, then the cursor will trace the next grid point with the corresponding snap spacing given in the X and Y axes, refer to (3) in Figure 3-5.

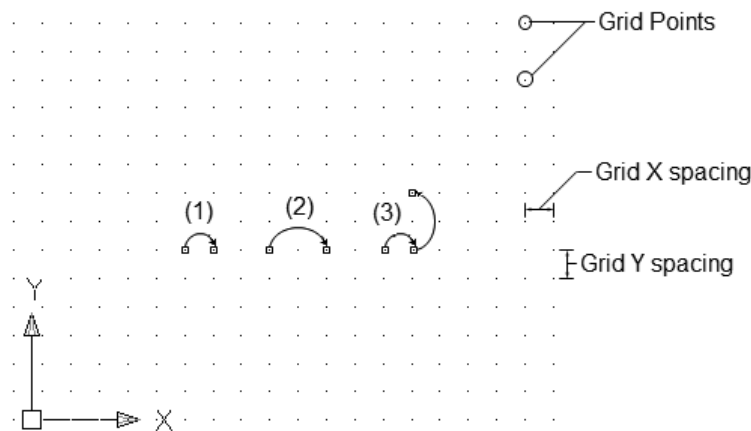


Figure 3-5 Different grid snapping options with grid details

## Snap type

The options in the **Snap type** area are used to specify the snap type. To snap the cursor to grid points in the X and Y axes, select the **Grid snap** radio button. In the grid snap mode, you can choose suitable option depending on your drawing requirement. To draw a geometric model in the rectangular snap mode, select the **Rectangular snap** radio button. To draw a geometric model in the isometric snap mode, select the **Isometric snap** radio button. While working in **Polar Tracking** mode, you can set the cursor to snap along the polar alignment angles by selecting the **PolarSnap** radio button.

## Object Snap Tab

The options in the **Object Snap** tab are used to snap to geometric points on a drawing object. To do so, choose the **Object Snap** tab from the **Drafting Setting** dialog box; the options in the **Object Snap** tab will be displayed. You can select the **Object Snap On** check box to toggle the object snap on or off. Additionally, you can select the **Object Snap Tracking On** check box to toggle the object snap tracking on or off. The options in the **Object Snap modes** area are used to control the object snap tracking types. The different options for object snap tracking settings can be used by choosing the preferred option for your project requirement. Some of the most frequently used object snap tracking options are discussed next.



**Tip:** You can also turn on an object snap option by right-clicking on the **Object Snap** button in the Status Bar, and then choosing the required snapping option from the shortcut menu displayed.

## Endpoint



The **Endpoint** object snap tracking option is used to draw an object with reference to an endpoint or the corner of another drawing object. If you select the **Endpoint** check box, the crosshair will trace the endpoint of the drawing object in the drawing mode. The endpoint object snapping is illustrated in Figure 3-6.

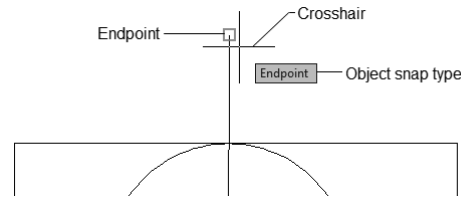


Figure 3-6 The Endpoint object snapping



## Midpoint

The **Midpoint** object snap option is used to draw an object with reference to the middle point of a line drawing. If you select the **Midpoint** check box, the crosshair will snap to the middle point of a nearby line drawing. The midpoint object snapping is illustrated in Figure 3-7.

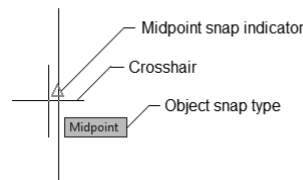


Figure 3-7 The Midpoint object snapping



## Center

The **Center** object snap option is used to track the center of a circle, arc, ellipse, or elliptical arc and then draw objects with reference to the center. To use this option in the drawing, select the **Center** check box. Figure 3-8 shows an example of the **Center** object snapping.



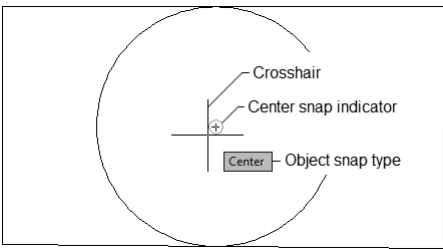



Figure 3-8 The Center object snapping

**Tangent**

 The **Tangent** object snap option is used to track a tangent point along an arc and a circular geometry. To invoke this option, select the **Tangent** check box. The tangent object snapping is illustrated in Figure 3-9.

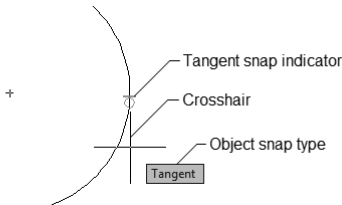



Figure 3-9 The Tangent object snapping

**Quadrant**

 The **Quadrant** object snap option is used to create a drawing with respect to one of the four quadrant points. To invoke this option, select the **Quadrant** check box. Figure 3-10 illustrates an example of using the **Quadrant** object snap option.

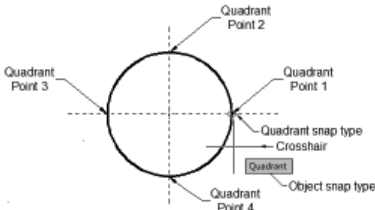



Figure 3-10 The Quadrant object snap located at the first quadrant

**Node**

 The **Node** option is used to snap to a point object in the drawing mode. To apply the node object snapping to the drawing mode, select the **Node** check box. You can draw a line from the point object by using this option. An example for drawing the line diagram using three point (nodes) is shown in Figure 3-11.

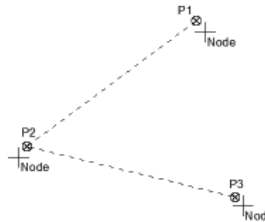



Figure 3-11 The Node object snapping



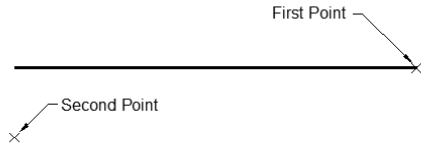
**Note**

The other object snap options such as **Intersection**, **Extension**, **Insertion**, **Perpendicular**, **Nearest**, **Apparent Intersection**, and **Parallel** are used to snap crosshair at different points along the drawing objects in the drawing mode.

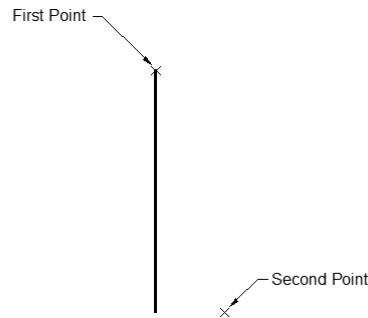
**WORKING IN THE ORTHO MODE**

 You can turn the Ortho mode on or off by choosing the **Ortho Mode** button in the Status Bar, or by using the F8 key. The Ortho mode allows you to draw lines at right angles only. Whenever you use the pointing device to specify the next point, the movement of the rubber-band line connected to the cursor will be either horizontal (parallel to the X axis) or vertical (parallel to the Y axis). To draw a line in the Ortho mode, specify the starting point

at the **Specify first point** prompt. To specify the second point, move the cursor with the pointing device and specify the desired point. The line thus drawn will be either vertical or horizontal, depending on the direction of movement of the cursor, see Figures 3-12 and 3-13.



**Figure 3-12** Drawing a horizontal line using the Ortho mode

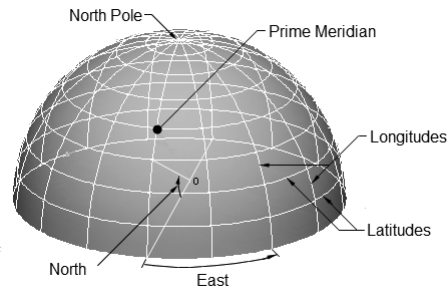


**Figure 3-13** Drawing a vertical line using the Ortho mode

## COORDINATE SYSTEM

A coordinate system is the most essential part of the data preparatory work. It acts as a base in the mapping procedures such as georeferencing, creating feature data, aligning the raster data, and so on. The coordinate system helps specify the location of the points in the form of Geodetic coordinate system (Latitude, Longitude, Datum Height), or UTM coordinate system (North, East, Height), or Cartesian coordinate system (X,Y, and Z). The coordinate systems used for different GIS data may be different. Some of the examples of the coordinate systems used are WGS-86, USGS, NAD-83, and so on.

An example of a coordinate system that is cut horizontally along the equatorial plane is shown in Figure 3-14. This system illustrates various elements of a coordinate system. In this model, Latitudes are represented by horizontal lines and Longitudes are represented by vertical lines. The Prime Meridian located at the Royal Observatory, Greenwich, is used as a reference point for measuring Longitudes or East/West angles. The direction of angle measurement is shown with the help of an arrow. The North and South angles are measured with reference to the Equatorial plane.



**Figure 3-14** A coordinate system showing Latitudes and Longitudes

There are two types of coordinate systems used in the AutoCAD Map 3D drawing environment: World Coordinate System (WCS) and User Coordinate System (UCS). The WCS is a Global Coordinate System that cannot be modified or aligned to a particular drawing object. The UCS is a coordinate system that can be modified, adjusted, and aligned as per the drawing requirements.

## DEFINING A NEW COORDINATE SYSTEM

**Ribbon:** Home > Coord System > Define Coordinate System  
**Command:** ADEDEFCRDSYS

You can define a new global coordinate system in a category based on your project requirement. To define a global coordinate system a user must have good knowledge of the terrestrial and celestial reference systems. Also, you must have sufficient legal rights to define a coordinate system.



### Note

*It is recommended that a user must know thoroughly the concepts of the terrestrial and celestial reference systems. If you do not have sufficient knowledge and accurate defining parameters, then avoid defining a new global coordinate system.*

To define a new global coordinate system, you need access to the folder containing the coordinate systems. To get the access to these folders follow the steps given below.

1. Close the **AutoCAD Map 3D 2011** software application, if it is running.
2. Open the **Windows Explorer** and display all the hidden folders. To display the hidden folders, browse to the following link and read the instructions.

*<http://windows.microsoft.com/en-US/windows-vista/Show-hidden-files>*

3. In the **Window Explorer**, browse to the following folder location:

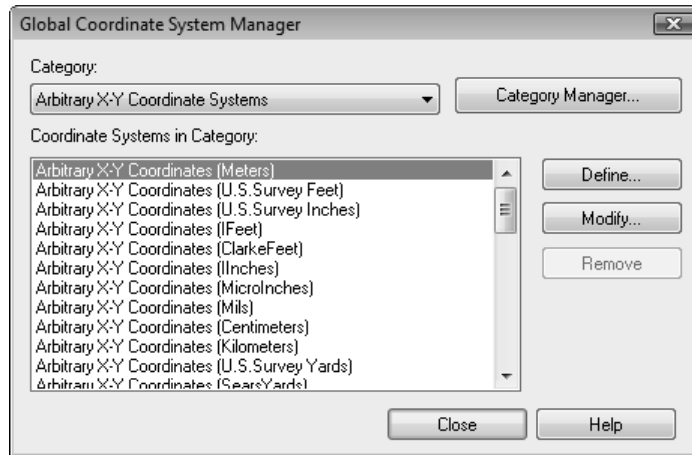
*C:\ProgramData\Autodesk*

4. In the **Autodesk** folder, right-click on the **Geospatial Coordinate Systems** folder; a menu will be displayed. In the menu, choose the **Properties** option; the **Geospatial Coordinate Systems Properties** dialog box will be displayed.
5. In this dialog box, choose the **Security** tab; the options in this tab will be displayed. Choose the **Edit** button in this tab; the **Permissions for Geospatial Coordinate Systems** dialog box will be displayed.
6. In this dialog box, select a user name from the **Group or user names** list box; the permissions assigned to the selected user will be displayed in the **Permissions for users** list box.
7. In the **Permissions for users** list box, select the check box corresponding to the **Full Control** option in the **Allow** column.
8. Next, choose the **Apply** button and then choose the **OK** button from this dialog box; the **Permissions for Geospatial Coordinate Systems** dialog box will be closed and the settings will be saved.

9. Again, choose the **OK** button in the **Geospatial Coordinate Systems Properties** dialog box; this dialog box will be closed.



After setting the user access, you can define a coordinate system based on the mapping, modeling, or project requirements. To do so, choose the **Define Coordinate System** tool from the **Coord System** panel; the **Global Coordinate System Manager** dialog box will be displayed, as shown in Figure 3-15.



*Figure 3-15 The Global Coordinate System Manager dialog box*

In this dialog box, you can define a new category or edit an existing category in the list box. To do so, select an option from the **Category** drop-down list. If you want to create a new category of the global coordinate system, choose the **Category Manager** button; the **Coordinate System Category Manager** dialog box will be displayed.

In the **Coordinate System Category Manager** dialog box, you can define a new category as well as edit or delete an existing category of the coordinate systems. To define a new category, choose the **New** button; the **New Category** dialog box will be displayed. In this dialog box, specify a name for the new category in the **Category Name** edit box. To add a coordinate system to the new category, select an option from the **Available Categories** drop-down list and then select an option from the **Coordinate Systems in Category** list box. Next, choose the **Add** button to add the selected option to the **Coordinate Systems in Category** list box for the newly defined category. To remove an option from the list of coordinate systems in a category, select the option and choose the **Remove** button. After specifying the coordinate systems in the new category, choose the **OK** button in this dialog box; the dialog box will be closed. Again, choose the **Close** button from the **Coordinate System Category Manager** dialog box; the dialog box will close and you will return to the **Global Coordinate System Manager** dialog box.

To define a new coordinate system in the required category, select an option from the **Coordinate Systems in Category** list box and then choose the **Define** button; the **Define Global Coordinate System** dialog box will be displayed, as shown in Figure 3-16. The options in the **General** and **Projection** tabs are discussed next.

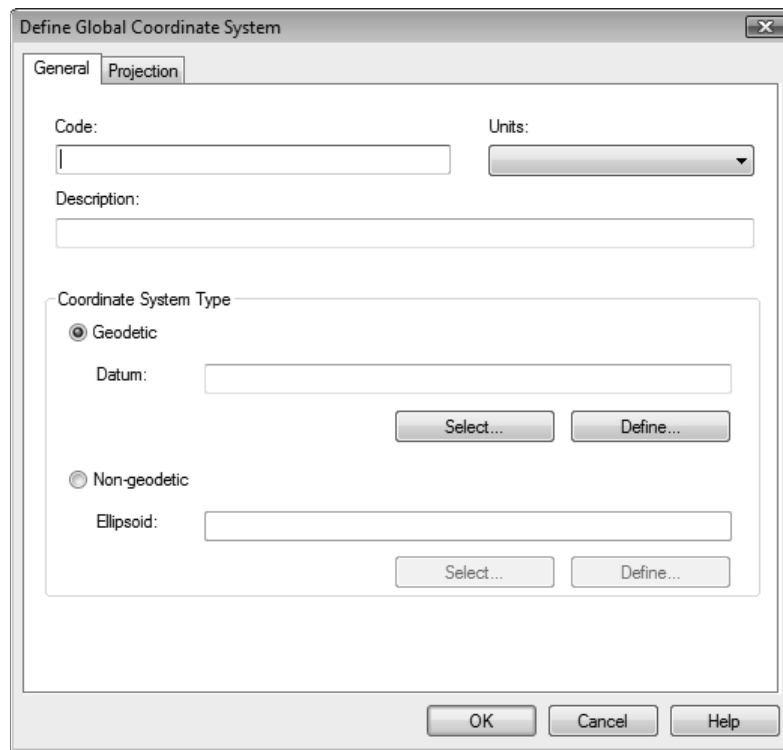


Figure 3-16 The *Define Global Coordinate System* dialog box with the **General** tab chosen

## General Tab

The **General** tab is chosen by default in the **Define Global Coordinate System** dialog box, refer to Figure 3-16. To apply a code for the coordinate system, enter a name in the **Code** edit box. To apply a measuring unit to the coordinate system, select an option from the **Units** drop-down list. You can enter details about the zone and coordinate system in the **Description** edit box.

You can apply the geodetic constraints to the new coordinate system. In the **Coordinate System Type** area of this tab, the **Geodetic** radio button is selected by default. As a result, the options corresponding to this radio button will be activated and you will be prompted to specify the geodetic parameters for defining a coordinate system. Alternatively, you can select the **Non-geodetic** radio button to specify the non-geodetic parameters for defining a coordinate system. Next, you need to specify the coordinate system to be used for defining the new coordinate system by using the **Select** or **Define** button. These buttons are discussed next.

## Select Button

The **Select** button is used to specify datum from a predefined coordinate system. To do so, choose the **Select** button; the **Select Datum** dialog box will be displayed. In this dialog box, select an option from the **Datums** list box and then use the **Properties** button to display the details of the selected datum. After selecting a desired option from the **Datums** list box, choose the **OK** button; the **Select Datum** dialog box will close and the code of the selected datum will display in the **Datum** edit box.

## Define Button

The **Define** button is used to define new parameters or modify the parameters of an existing datum, and then use these parameters to the new coordinate system. To define parameters, choose the **Define** button; the **Datum Manager** dialog box will be displayed. In the **Datum Manager** dialog box, choose the **Define** button; the **Define Datum** dialog box will be displayed.

In this dialog box, you can apply datum transformation to a coordinate system as per your requirement. To do so, enter the properties of the datum such as **Code**, **Description**, and **Ellipsoid** and then choose the **Datum Conversion** tab. To apply a suitable methodology for the transformation of a coordinate system, select an option from the **Datum Conversion Technique** drop-down list. In the **Datum Conversion** tab of the **Define Datum** dialog box, the options in the **Conversion Parameters** area are used to specify the transformation parameters. Either you can enter the distance parameters in the **Delta X**, **Delta Y**, and **Delta Z** edit boxes in the **Vector Component Deltas to WGS-84 in Meters** area. Alternatively, you can specify the values for the X, Y, and Z axes by entering the required values in the **X Axis**, **Y Axis**, and **Z Axis** edit boxes in the **Rotation Angle from WGS-84 in Arc Seconds** area. Next, specify the scale factor by entering the required value in the **Scale Factor (parts per million)** edit box. Next, choose the **OK** and **Close** buttons consecutively to close the **Define Datum** and **Datum Manager** dialog boxes and return to the **Define Global Coordinate System** dialog box.



### Note

The **Molodensky technique** option is selected by default in the **Datum Conversion Technique** drop-down list. As a result, the **Rotation Angle from WGS-84 in Arc Seconds** area will be inactive.



**Tip:** You can follow the procedure used to define a geodetic coordinate system to define a non-geodetic coordinate system, except the parameters to applied and name in the title bar are different.

## Projection Tab

The options in the **Projection** tab are used to specify the projection parameters of the new coordinate system. You can specify a projection type by selecting an option from the **Projection** drop-down list. Use the options in the **False Origin** area to change the origin. To modify the northing and easting values for the new projection, enter the new values in the **Northing** and **Easting** edit boxes. Depending on the projection type selected in the **Projection** drop-down list, the projection parameters will be displayed in the **Projection Parameters** area. The projection parameters are used to specify the accurate position of the new origin. To specify the required corrections to the given projection type. Choose the **OK** button to save all the specified parameters and return to the **Global Coordinate System Manager** dialog box. Next, choose the **Close** button in this dialog box; the dialog box will be closed.



**Tip:** Similar to the process of defining a coordinate system, you can also modify an existing coordinate system. To modify an existing coordinate system, select an option from the **Coordinate Systems in Category** list box and then choose the **Modify** button from the **Global Coordinate System Manager** dialog box. Next, follow the same procedure as that of defining a coordinate system.

## COORDINATE SYSTEMS IN AutoCAD

The User Coordinate System, commonly known as UCS, is used to align drawings, blocks, maps, and 3D models as per the project requirements. The dynamic UCS is used to apply temporary axis icon to models. The different options used to modify or align the UCS triad in the drawing environment are discussed next.

### World Coordinate System

**Ribbon:** View > Coordinates > World



The World Coordinate System (WCS) is used to set the drawing environment to a fixed coordinate system or world coordinate system. To set the World Coordinate System to the current drawing, choose the **World** tool from the **Coordinates** panel; the UCS triad will be set to the origin.

### User Coordinate System

The User Coordinate System (UCS) is used to apply an X, Y, and Z axes system to the entire drawing or to a single drawing object. The methods to align the UCS triad are discussed next.

### Moving the UCS Triad

**Ribbon:** View > Coordinates > UCS



To move the UCS triad, choose the **UCS** tool from the **Coordinates** panel; the cursor changes into crosshair in the Drawing Window. Now, place the crosshair at the required point and then left-click; the UCS triad moves to the specified point. Next, press ENTER; the position of the UCS triad will be fixed to the specified point.

### Rotating the UCS Triad about the X Axis

**Ribbon:** View > Coordinates > X



You can rotate the UCS about the X axis in the YZ plane. To rotate the UCS icon in the YZ plane while keeping the X axis fixed, choose the **X** tool from the **Coordinates** panel; the cursor changes to a crosshair in the Drawing Window and the **Specify rotation angle about X axis <90>** statement will be displayed in the **Command Line**. Enter the rotation angle and press ENTER; the UCS will rotate about the X axis. The angle of rotation can be applied to the UCS icon, as shown in Figure 3-17.

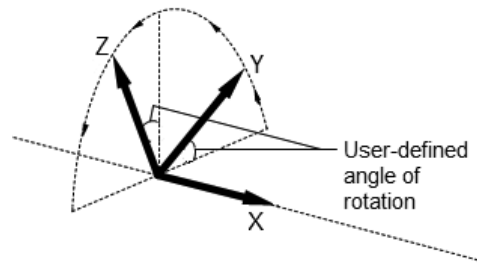


Figure 3-17 Rotating the UCS icon keeping the X axis fixed

## Using a Named UCS for Drawings

**Ribbon:** View > Coordinates > Named



You can assign a name to the modified UCS and then use it anytime during the drawing process. The UCS settings that need to be applied to many drawing objects in the project can be saved as a template, so that you can use the new template for many drawing objects as per project requirement. In the previous section of this chapter, you learned how to realign an UCS as per your requirement. To specify a named UCS for drawings in the project, choose the **Named** tool from the **Coordinates** panel; the **UCS** dialog box will be displayed, as shown in Figure 3-18. The **Named UCSs**, **Orthographic UCSs**, and **Settings** tabs in the **UCS** dialog box are discussed next.

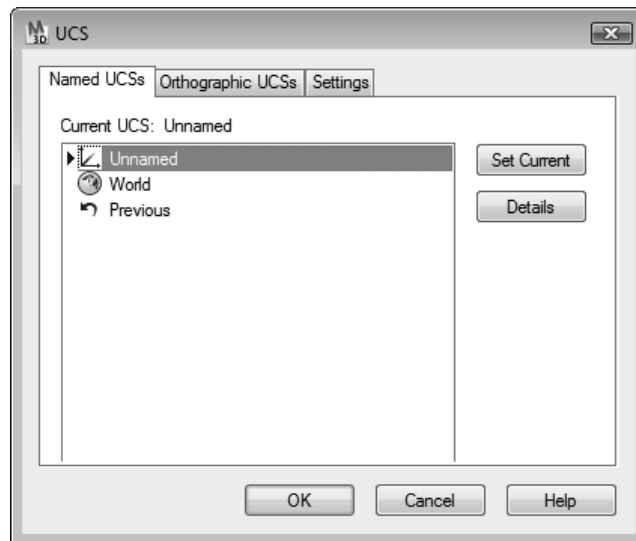


Figure 3-18 The UCS dialog box

### Named UCSs Tab

The options in the **Named UCSs** tab are used to specify a name for the modified UCS settings and to set a named UCS as the current UCS. In the **UCS** dialog box, choose the **Named UCSs** tab, if it is not chosen by default. To rename a UCS, select it from the **Current UCS** list box



and then right-click on the **Unnamed** option; a shortcut menu will be displayed. Choose the **Rename** option from this shortcut menu; the **Unnamed** option will change into a edit box. In this edit box, enter a name as per your requirement, and then click outside this edit box or choose the **OK** button to apply the name.

**Note**

*The **Unnamed** option will appear only if you have modified the alignment of the default UCS icon.*

**Orthographic UCSs Tab**

The options in the **Orthographic UCSs** tab of the **UCS** dialog box are used to apply the orthographic coordinate system to the current drawing with reference to the available coordinate system. To apply a particular orthographic coordinate system to the current drawing, choose an option from the **Name** list box in the **UCS** dialog box. To apply the orthographic coordinate system with reference to an available coordinate system, choose an option from the **Relative to** drop-down list. To apply the modified settings to a coordinate system, choose the **Set Current** button. Next, choose the **OK** button; the UCS triad will change to the settings specified in the Drawing Window.

**Settings Tab**

The options in the **Settings** tab are used to specify the displaying and aligning properties of the UCS triad. These settings are discussed next.

**UCS Icon settings Area**

The options in the **UCS Icon settings** area are used to set the properties of the UCS icon. To hide the UCS icon from the Drawing Window, clear the **On** check box. To display the UCS icon at the lower left corner of the Drawing Window instead of displaying it at the origin of the coordinate system, clear the **Display at UCS origin point** check box. To apply the modified UCS settings to all viewports in the current drawing, select the **Apply to all active viewports** check box.

**UCS settings Area**

The options in the **UCS settings** area are used to set viewports with UCS. The **Save UCS with viewport** check box is selected by default in this area. As a result, the modified UCS settings will be saved with the current viewport. If you clear the **Save UCS with viewport** check box, the modified settings will be applied to the entire drawing. To apply the current UCS settings to the viewport ignoring the UCS settings applied to a particular viewport, clear the **Save UCS with viewport** check box. To restore the plan view when the coordinate system in the viewport is changed, select the **Update view to Plan when UCS is changed** check box. Next, choose the **OK** button to close the dialog box.

**Assigning a Coordinate System to Data**

**Ribbon:** Home > Coord System > Assign



Coordinates are used to define the location of data with respect to a fixed origin. A coordinate system assigned to a dataset is useful for conducting spatial analysis to achieve the required results. A coordinate system can be applied to two kinds of data:

data in an external source and data in the current drawing system. To assign a coordinate system to a data file, choose the **Assign** tool from the **Coord System** panel; the **Assign Global Coordinate System** dialog box will be displayed, as shown in Figure 3-19. The different methods used to assign the desired coordinate systems to a drawing are discussed next.

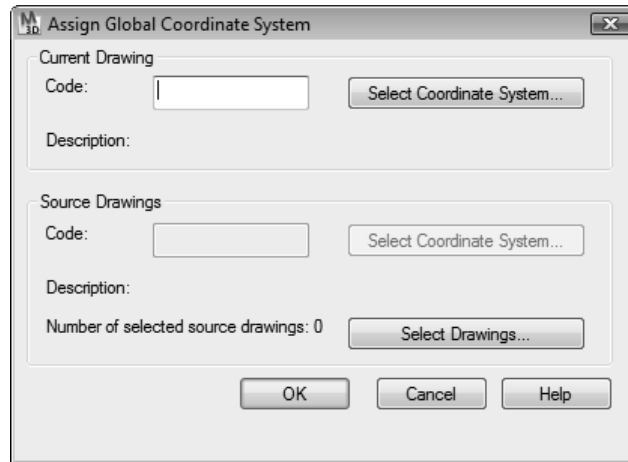


Figure 3-19 The Assign Global Coordinate System dialog box

### Assigning a Coordinate System to the Drawing File in an External Source

The options in the **Source Drawings** area in the **Assign Global Coordinate System** dialog box are used to assign a coordinate system to the drawing file in an external source. To select the drawing from an external folder, choose the **Select Drawings** button; the **Select Drawings to Assign Coordinate System** dialog box will be displayed. In this dialog box, select the required drawing file and choose the **Add** button; the drawing file will be added with its location in the **Selected drawings** list box at the bottom of the dialog box. Next, choose the **OK** button; the dialog box will be closed and the **Number of selected source drawings** option in the **Assign Global Coordinate System** dialog box will be updated.

On selecting a drawing file from an external source, the **Select Coordinate System** button becomes active. To assign a coordinate system to the selected drawing, choose the **Select Coordinate System** button; the **Select Global Coordinate System** dialog box will be displayed. In this dialog box, select a option from the **Category** drop-down list; all coordinate systems pertaining to the selected category will be displayed in the **Coordinate Systems in Category** list box. Select the required coordinate system from the list box and choose the **OK** button to close the dialog box; the code of the selected coordinate system will be displayed in the **Code** edit box, and the description of the selected coordinate system will be displayed below the edit box.

### Assigning a Coordinate System to the Current Drawing File

You can assign a coordinate system to the current drawing file after loading it into the Workspace. To assign the required coordinate system to the current drawing, enter the code of the coordinate system in the **Code** edit box. To assign a global coordinate system to the current drawing, follow the same procedure explained in the previous paragraph.

## Assigning a Coordinate System to a Dataset while Using the Connect Tool

A coordinate system can be assigned to a dataset, while using the **Connect** tool to load the data into the Workspace. Select data in an external data format by using the **Connect** tool as explained in the previous chapter, and then choose the **Edit Coordinate Systems** button located at the top of the list box; the **Edit Spatial Contexts** dialog box will be displayed, as shown in Figure 3-20.

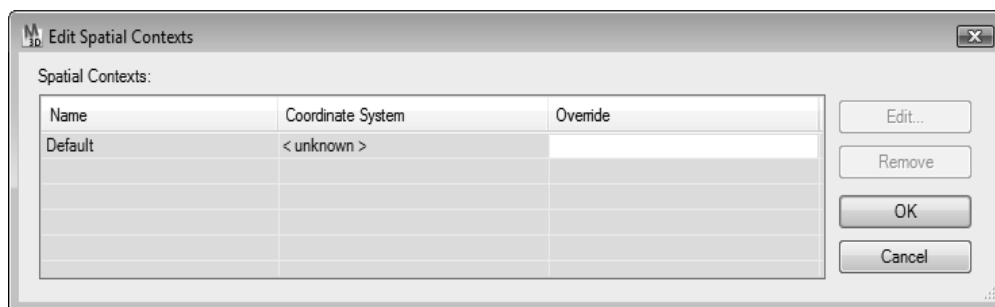


Figure 3-20 The *Edit Spatial Contexts* dialog box

To assign a new coordinate system or edit an existing coordinate system, select the **Default** option in this dialog box; the **Edit** button becomes active. Choose the **Edit** button; the **Select Coordinate System** dialog box will be displayed. Select the required coordinate system from this dialog box and then proceed as explained in the previous section.

## TUTORIALS

General instructions for downloading tutorial files:

1. Download the *c03-map3d-2011-prt* zipped folder from the following link:

<http://www.cadcim.com/map3d-2011/map3d-2011.htm>

2. Now, save and extract the downloaded folder at the following location:

*C:\Map3D\_2011\c03*

### Tutorial 1

### Assigning GCS to Workspace

In this tutorial, you will assign a Global Coordinate System (GCS) to the current Workspace and source drawing file. You will also define a new global coordinate system and add different datasets under the same global coordinate system. (Expected time: 15min)

The following steps are required to complete this tutorial:


- a. Start a new drawing file.

- b. Assign the **NE83 - NAD83 Nebraska State Planes, Meter** coordinate system to the current Workspace.
- c. Save the file

### Starting a New Drawing File

1. Choose **New** from the Menu Browser; the **Select template** dialog box is displayed.
2. In the **Select template** dialog box, select the *map2d* template file in the list box below the **Look in** drop-down list and then choose the **Open** button; the *map2d* template is applied to the Modelspace.

### Assigning a Global Coordinate System to the Current Workspace

1. To assign the required global coordinate system, choose the **Assign** tool from the **Coord System** panel in the **Assign Global Coordinate System** tab; the dialog box is displayed. 
2. In the **Assign Global Coordinate System** dialog box, choose the **Select Coordinate System** button; the **Select Global Coordinate System** dialog box is displayed.
3. In the **Select Global Coordinate System** dialog box, select the **USA, Nebraska** option from the **Category** drop-down list; a list of coordinate systems in the selected category is displayed in the **Coordinate Systems in Category** list box.
4. Select the **NE83 - NAD83 Nebraska State Planes, Meter** option from the **Coordinate Systems in Category** list box, if it is not selected by default, and then choose the **OK** button; the code of the selected coordinate system is displayed in the **Code** edit box and the description of that coordinate system is displayed below the edit box in the **Current Drawing** area.
5. Choose the **OK** button; the selected coordinate system is assigned to the Workspace.

### Saving the Drawing File

1. Choose the **Save As** option in the Menu Browser; the **Save Drawing As** dialog box is displayed.
  2. In the **Save Drawing As** dialog box, enter **c03-map3d-2011-tut01a** in the **File name** edit box and select the **AutoCAD 2010 Drawing (\*.dwg)** option in the **Files of type** drop-down list, if it is not selected by default.
  3. In the **Save Drawing As** dialog box, choose the **Save** button next to the **File name** edit box; the current drawing file is saved with the given name.
-

## Tutorial 2 Assigning GCS to the Source Drawing

In this tutorial, you will assign a coordinate system to the source drawing file.

(Expected time: 20min)


The following steps are required to complete this tutorial:

- Start a drawing file by applying the *map2d* template file.
- Assign the **WORLD-LL No geodetic datum, Latitude-Longitude; Degrees** coordinate system from the **World/Continental** coordinate system category to the source drawing.
- Save the file.

### Starting a Drawing File

- Choose **New** from the Quick Access Toolbar; a new drawing is started.
- In the **Select template** dialog box, select the *map2d* template file in the list box below the **Look in** drop-down list and then choose the **Open** button; the *map2d* template is applied to the Modelspace.

### Assigning a Global Coordinate System to the Source Drawing

- To select the required global coordinate system, choose the **Assign** tool from the **Coord System** panel in the **Home** tab; the **Assign Global Coordinate System** dialog box is displayed.  Assign
- In the **Assign Global Coordinate System** dialog box, choose the **Select Drawings** button in the **Source Drawings** area; the **Select Drawings to Assign Coordinate System** dialog box is displayed.
- In the **Select Drawings to Assign Coordinate System** dialog box, browse to the following location:  
  
`C:\Map3D_2011\c03\c03_tut02`
- Then, select the *c03-map3d-2011-tut02.dwg* file from the list box; the **Add** button below the list box gets activated.
- Choose the **Add** button; the path of the *c03-map3d-2011-tut02.dwg* file is displayed in the **Selected drawings** list box.
- Choose the **OK** button; the **Select Drawings to Assign Coordinate System** dialog box is closed and the **Number of selected source drawings** is updated to **1** in the **Source Drawings** area of the **Assign Global Coordinate System** dialog box.
- In the **Assign Global Coordinate System** dialog box, choose the **Select Coordinate System** button in the **Source Drawings** area; the **Select Global Coordinate System** dialog box is displayed.

8. In the **Select Global Coordinate System** dialog box, select the **World/Continental** option from the **Category** drop-down list; a list of coordinate systems in the selected category is displayed in the **Coordinate Systems in Category** list box.
9. In the **Coordinate Systems in Category** list box, select the **WORLD-LL No geodetic datum, Latitude-Longitude; Degrees** option.
10. Choose the **OK** button; the **Select Global Coordinate System** dialog box is closed and the **WORLD-LL** code is displayed in the **Code** edit box and its description is displayed below the **Code** edit box in the **Assign Global Coordinate System** dialog box. Next, choose the **OK** button; the **Assign Global Coordinate System** dialog box is closed and the source drawing file is saved with the selected coordinate system.

### Saving the Drawing File

1. Choose the **Save As** option in the Menu Browser; the **Save Drawing As** dialog box is displayed.
2. In the **Save Drawing As** dialog box, enter **c03-map3d-2011-tut02a** in the **File name** edit box and select the **AutoCAD 2010 Drawing (\*.dwg)** option in the **Files of type** drop-down list, if it is not selected by default.
3. In the **Save Drawing As** dialog box, choose the **Save** button next to the **File name** edit box; the current drawing file is saved with the given name.

## Tutorial 3

## Assigning GCS while Loading Data

In this tutorial, you will assign a global coordinate system (GCS) to a dataset while loading data by using the **Connect** tool. **(Expected time: 20min)**

The following steps are required to complete this tutorial:

- a. Start a new drawing file.
- b. Assign the **IslandsNET1993.LL ISN93** coordinate system from the **Iceland** category to the dataset while loading data by using the **Connect** tool.
- c. Save the file.

### Starting a New Drawing File

1. Choose **New** from the Menu Browser; the **Select template** dialog box is displayed.
2. In the **Select template** dialog box, select the *map2d* template file in the list box below the **Look in** drop-down list, and then choose the **Open** button; the *map2d* template is applied to the Modelspace.

## Assigning the Coordinate System while Loading a Dataset Using the Data Connect Tool

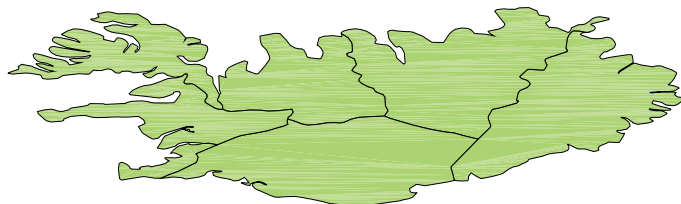
1. Choose the **Connect** tool from the **Data** panel in the **Home** tab; the **Data Connect** wizard is displayed.
2. In the **Data Connect** wizard, select the **Add SHP Connection** option from the **Data Provider by Connection** list box; the **OSGeo FDO Provider for SHP** page is displayed in the right side of this dialog box.
3. In the **OSGeo FDO Provider for SHP** page, choose the browse button next to the **Source file or folder** edit box; the **Open** dialog box is displayed. In this dialog box, browse to the following location:



*C:\Map3D\_2011\c03\c03\_tut03*

4. Next, select the **c03-map3d-2011-tut03** option from the list box and then choose the **Open** button; the **Open** dialog box is closed and the path of the shape file is added into the **Source file or folder** edit box in the **OSGeo FDO Provider for SHP** page.
5. Choose the **Connect** button; the selected shape file is displayed in the **Add Data to Map** list box.
6. Choose the **Edit Coordinate System** button in the **Add Data to Map** area; the **Edit Spatial Contexts** dialog box is displayed.
7. In the **Edit Spatial Contexts** dialog box, select the first row and then choose the **Edit** button; the **Select Coordinate System** dialog box is displayed.
8. In the **Select Coordinate System** dialog box, select the **Iceland** option from the **Category** drop-down list; a list of coordinate systems in the selected category is displayed in the **Coordinate Systems by Category** list box.
9. Select the **IslandsNET1993.LL ISN93** option from the **Coordinate Systems by Category** list box.
10. Choose the **OK** button in the **Select Coordinate System** dialog box; this dialog box is closed and the **IslandsNet1993.LL** code is displayed in the **Override** column of the **Edit Spatial Contexts** dialog box.
11. In the **Edit Spatial Contexts** dialog box, choose the **OK** button; this dialog box closes and the selected coordinate system is assigned to the shape file.
12. Choose the **Add to Map** button; the shape file is connected to the Workspace and the geometry of the shape file is displayed in the Drawing Window.

13. Close the **Data Connect** wizard by choosing the Close [X] button from the upper right corner; this dialog box is closed and the geometry of the shape file is displayed in the Drawing Window, as shown in Figure 3-21.



*Figure 3-21 Model created by combining various features*

### Saving the Drawing File

1. Choose the **Save As** option in the Menu Browser; the **Save Drawing As** dialog box is displayed.
2. In the **Save Drawing As** dialog box, enter **c03-map3d-2011-tut03a** in the **File name** edit box and select the **AutoCAD 2010 Drawing (\*.dwg)** option in the **Files of type** drop-down list, if it is not selected by default.
3. In the **Save Drawing As** dialog box, choose the **Save** button next to the **File name** edit box; the current drawing file is saved with the given name.

### Self-Evaluation Test

Answer the following questions and then compare them to those given at the end of this chapter:

1. You can use the **Extents** zooming option to stretch a selected layer to the limits of the Drawing Window. (T/F)
2. The **Pan** tool cannot be used to move and place a drawing object to the required position. (T/F)
3. As you increase the scale value in the **ViewScale** option in the Status Bar, the size of the corresponding drawing or image decreases in the Drawing Window. (T/F)
4. When you are working in the Ortho mode, you can draw lines along any direction. (T/F)
5. After turning on the **Object Snap** mode, you can track the endpoint of a line by using the \_\_\_\_\_ object snap option.



6. The **Quadrant** object snap option is used to track a circle at \_\_\_\_\_.
7. You can define a new global coordinate system as per your requirement. (T/F)
8. You cannot align the User Coordinate System (UCS) about any other direction. (T/F)
9. You cannot assign a coordinate system to a drawing file in an external source. (T/F)
10. You can assign a coordinate system to a dataset while using the **Connect** tool to load data. (T/F)

### Review Questions

Answer the following questions:

1. Which of the following zooming options is used to display the previous drawing mode?
  - (a) **Window**
  - (b) **Realtime**
  - (c) **Previous**
  - (d) **Object**
2. The scale fixing used for drawing and view is different. (T/F)
3. The grid spacing and snapping cannot be adjusted as per the user requirement. (T/F)
4. The **Midpoint** object snap option is used to track the center of an arc, a circle, or an ellipse. (T/F)
5. To define a new global coordinate system, you can use the coordinate systems from an existing category of a coordinate system. (T/F)
6. By specifying projection parameters, you can transform a coordinate system from one system to another system. (T/F)
7. The \_\_\_\_\_ option in the **Coordinates** panel of the **View** tab is used to set the World Coordinate System to the UCS.
8. You can assign a coordinate system to the current drawing as well as to the drawing located in an external location. (T/F)
9. You can specify the coordinate system of a dataset while loading them by using the **Connect** tool. (T/F)
10. You can track the coordinates in a drawing file by using the \_\_\_\_\_ option from the **Map Explorer** tab in the **Task Pane**.

## Exercises

### Exercise 1

Assign the **TX83-CF NAD83 Texas State Planes, Central Zone, US Foot** coordinate system in the **USA, Texas** category to the *c03-map3d-2011-exr01.dwg* file in the following folder location:

*C:\Map3D\_2011\c03\c03\_exr01*

(Expected time: 20min)

### Exercise 2

Change the coordinate system of the *city\_bound07.shp* file from **NE83F NAD83 Nebraska State Planes, US Foot** to **NE83 NAD83 Nebraska State Planes, Meter** while connecting it to the current drawing.

(Expected time: 30min)

### Answers to Self-Evaluation Test

1. T, 2. F, 3. T, 4. F, 5. Endpoint, 6. Quadrants, 7. T, 8. F, 9. F, 10. T