Section 5.6.2 describes the drawing package available in both Word and PowerPoint. This note supplements the information provided there. The drawing package enables you to construct and edit graphics figures and illustrations in Word documents and in PowerPoint presentations. Figures can be copied between PowerPoint slides and Word documents, supporting both the oral and written reports on your engineering projects.

In both Word and PowerPoint graphic objects are created using a Drawing Toolbar located at the bottom left of the screen. If it is not there, select View, Toolbars and click the Drawing checkbox. To begin a drawing, move the cursor to a space between paragraphs where you want the drawing to go. When the first drawing object is selected from the toolbar, a drawing canvas will open up.

Lines, arrows, rectangles, ellipses and text boxes can be selected from the Drawing Toolbar. After the selection, lines and arrows are started and ended with a click. Rectangles and ellipses are dragged out to full size and moved into position. For circles, hold the shift key down while dragging. Many ready made shapes, like the arrow on the Ware Meter, can be selected from the AutoShapes menus. Closed objects have a default fill. To alter the fill of a selected object, choose the Fill Color (bucket) icon. To change the default fill, choose the icon with no object selected. Similarly, thickness and style of object lines are controlled via the Line Style icon and the Dash Style icon. Arrows are added or reversed with the Arrow Style Icon. Shadow and 3-D effects can be added to selected objects via the corresponding icons.

An elliptical or circular arc can be constructed, by choosing AutoShapes, Basic Shapes and selecting the arc. A quarter circle arc can then be dragged out from a starting point. The arc becomes circular if the Shift key is held down. Other connecting lines and curves between objects can be constructed by choosing Lines from the AutoShapes Menu. The FreeForm shape is a series of lines following the next mouse click. A double click ends the series. The Curve shape is a curve fitted through the series of points defined in the same way. The Scribble shape follows the mouse drag precisely.

Objects can be moved together by selecting them, then dragging a point at which the cursor takes on the move shape. Selection of multiple objects is done by enclosing the objects in a dragged rectangle with the Select Objects arrow on the Draw Toolbar, or by selecting objects with the shift key down. Selected objects are grouped to make them into a single graphics object. The text of the Word document can be made to flow around the object in several ways.

In this lab project, we will experiment with the drawing package, following directions below. Then we will draw Figure 5.19 of the text in the same Word document. First, open a new Word document and display the Drawing Toolbar if necessary. Type a heading and some text, leaving a paragraph gap. If you are unfamiliar with the drawing package, create objects in the drawing canvas mentioned above. Experiment with grouping, copying, flipping, and changing the overlay order of these objects.
Type a third paragraph and in the gap above it, create the block arrow AutoShape as suggested by Section 5.6.2. Use the yellow diamond handle to adjust the shape of the arrow. The square boxes that surround the selected graphic object are stretch boxes. An AutoShape or other graphic object can be stretched in horizontal or vertical directions alone. It can be adjusted in size in both dimensions by dragging a “diagonally marked” stretch box. Experiment with this and then adjust the size of the arrow to cover about a third of the drawing canvas.

Always complete your text paragraph before inserting a drawing immediately after it. The presence of the canvas makes the text line just before it misbehave during editing. To add to such text, just move the canvas to another place, edit the text, and move the canvas back.

Click away from the AutoShape and the handle boxes disappear. This means that the graphic object is no longer selected for sizing, movement, or other graphic operations. Approach the object again, and a shift of the cursor icon will tell you when the object can be selected again. The graphic object is moved on the canvas by dragging.

Experiment with the drawing canvas now. With the corners and sides handles, you can change the shape of the canvas without changing the drawing objects on it. This is the \textit{Expand} mode. In the popup toolbar, select the \textit{Scale Drawing} mode. Now change the shape of the canvas and notice the effect on the block arrow. Reselect the \textit{Expand} mode and narrow the canvas on both sides until it is about twice the length of the arrow.

Select the \textit{Text Wrapping} mode on the popup toolbar and experiment with text wrapping effects. Leaving it on \textit{Square}.

Add a brief paragraph describing the wrapping effect of \textit{Tight}, \textit{Behind Text}, \textit{In Front of Text}, and \textit{Through}.

With the Drawing Canvas selected, select \textbf{Format, Drawing Canvas}. Select a line style, weight (thickness) and color for a border around the drawing canvas. With the Text Box insertion button, add the figure caption “Fig.1 Block Arrow” to your drawing at the bottom of the drawing canvas. Remove the border on the caption and center it at the bottom of the canvas.
Figures drawn in your document may consist of more than one graphic object. To simulate this situation, enlarge the canvas, choose **AutoShapes, Basic Shapes** and place a smiley face in your figure. Make the smiley face similar in size to the arrow.

Your document now contains two graphic objects. Figures you draw into a Word document usually contain more than one graphic object, but when you want to resize or move the figure as a whole, you will want to redefine the figure as a single object. In the graphics package this is called “grouping”. Grouping is something you do to a selected set of objects. One way to select the set is drag a selection rectangle around them. The objects entirely within the rectangle are selected. Sometimes this does not appear to work because an object is really larger than its visible parts. Select the object and look at the handles to diagnose this problem. A second method of selecting a set of objects is to hold the shift key down while clicking on them. With the objects selected, grouping is completed by choosing **Draw, Group**.

Groups may be formed from graphic objects including groups, so complex figures may be treated as a single drawing object. When a group is selected, the **UnGroup** item on the **Draw** menu dissolves it into individual graphic objects. The Regroup item reconstitutes the last defined group, and is handy after ungrouping to edit individual members of a group. Try this out by ungrouping your two objects, and using the yellow diamond to change the mood of your smiley face, then regrouping.

Explore the **Draw, Order** commands by adding a third AutoShape to your group, positioning the AutoShapes to overlap, and reordering the group of three with the commands. Predict what will happen, based on the menu items, and confirm your predictions. Convert your group to one that slides under text, and confirm that it does. Write a brief paragraph summarizing the ordering capability of the drawing package.

Explore the flip and rotate commands with your AutoShape group. Selecting the group activates the flip menu and the rotate icon. Leave the group flipped both horizontally and vertically, and rotated about 20 degrees. Change the figure caption to read “Flipped and Rotated AutoShape Group”.

Finally, you are to draw the Figure 5.19 of the text over a suitable caption. Add a paragraph to document the location of this figure in the text, then another to explain what the drawing is showing. Then place the figure between these two paragraphs.

The hints supplement the instructions of Section 5.6, pages 71 and 72, and will be helpful in drawing this figure.

For perfect radar towers, stretch an isosceles triangle to the correct height, then place lines on the upright sides. Then delete the triangle.

Use the Alt key to override the “snap to grid” restrictions on cursor movement. Zoom the Word document to 200% or more to align objects well.
Hold the shift key down while dragging to create circles and circular arcs. Again, the arc is found on **AutoShapes, BasicShapes**.

Circles on the towers should be centered. To do that, draw the towers first, connect the points on the towers and put in the angle arcs (see below). Then put a circle on one tower and copy it (**Ctrl C, Ctrl V**) for the other tower, so that the circles have the same radius. To position the second circle, select no fill for it, then add the fill once its centered.

Draw the ground reflected wave lines as a Freeform object. Line and arrow styles can be applied to completed Freeform objects.

A method of constructing circular arcs for angles is described in the left column below Figure 5.19. Experiment with the arc drawing by creating and deleting several of them. Each arc drawn as you drag covers one quadrant. You can position a quarter circle accurately about a center, as shown below. When you release the mouse button you have diamonds at the endpoints for extending the arc and trimming it back to go between the angle lines. Then convert the arc to an arrow.

Although drawings can be positioned around existing text, this is not a practical method of producing the text within a figure. Instead, text is added to the existing drawing, as it is being produced. Each independently positioned piece of text is created with a Text Box. Expand the box to the size desired, and type within the box. Equation objects can be inserted within a text box. The style and visibility of text box borders are selected in the **Format** menu or by using the Drawing Toolbar. Normally you want "No Borders". Like rectangles, text boxes have a Fill Color. It can be selected with the Fill Color icon on the drawing menu, with a text box selected. "No Fill" is normally best for figures. You can create the “d” over the dimension line with a small text box with white fill covering a single line.