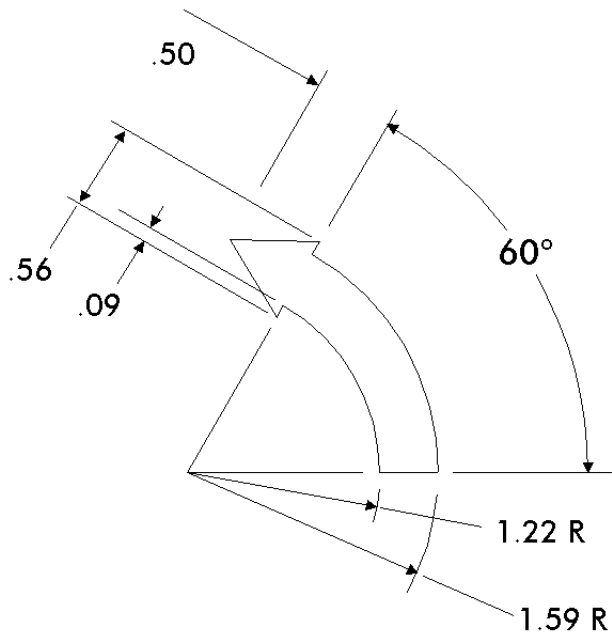


# Create an arrow with Draw, Offset, Snap, and Join

The drawing below shows an arrow that a machinist had to make. While you may not have to cut arrows, the techniques that you will learn in this example will apply to other shapes.



There are different ways to create the arrow. This chapter uses the **Draw Menu** and **offsets**. The **Draw Menu** was briefly described in Chapter 1, page 2.

STEP 1) DRAW THE 1.22 RADIUS ARC.

Bring up the **Draw** menu and pick the **Arc** option, either by clicking the **Draw** button with the mouse or by pressing **DJAJ**. The arc drawing fields will appear on the right side of the screen. For the sake of simplicity, set the center of the arc to X0,Y0.

Tip: MillWrite lets you move X0,Y0 easily, so when you want to draw a new shape, it is often easiest to move X0,Y0 to the center or a corner of the new item you are making. After you create the items you can move X0,Y0 back to where it should be.

According to the specs, the arc's radius is 1.22, and it has a sweep of 60°, so fill in those two values, as seen in Figure 3-1.

You have just specified enough information to create an arc, so MillWrite will draw a dotted arc to show you what the arc looks like.

Notice that MillWrite fills in the **start** and **end** coordinates for you, but the color for those coordinates is different than the color for the values that **you** entered. MillWrite fills in the empty fields in case you want to know what they are, and the values are displayed in a different color to show you that MillWrite, **not you**, entered the values.

The starting angle for this arc is 0°, and this arc is counter-clockwise, but by coincidence those are MillWrite's defaults for arcs, so you don't have to specify those values. If the arc had started at some other angle, then you would have to specify that angle.

This arc is complete, so click the **OK** button.

STEP 2) DRAW THE 1.59 RADIUS ARC.

Notice that the data fields are blank except for the **start** coordinates, as seen in Figure 3.2.

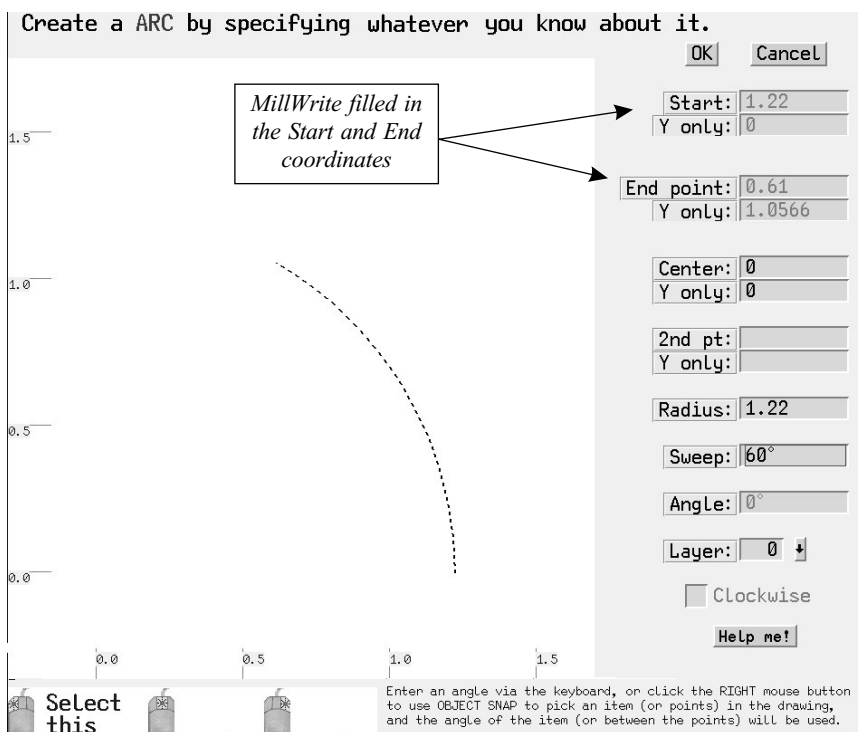


Figure 3-1

MillWrite filled in the **start** coordinates with the **end** point of the previous arc in case you want this new arc to continue from the previous arc. However, the arc you will now create does not continue from the previous arc, so ignore the values you see. You do **not** need to clear those values.

This arc has the same center point of X0, Y0, the same sweep of 60°, and its radius is 1.59. Fill in those values, and you should see a dotted arc. Also, notice that MillWrite changed the **start** coordinates and filled in the **end** coordinates, as seen in Figure 3-3.

Click the **OK** button to accept the arc, and then click either the **OK** or **Cancel** button to quit drawing arcs, or press the **Esc** key.

### STEP 3) DRAW THE ARROW'S TAIL.

You have drawn two arcs. Each arc has two “nodes” and a center point. Now you have to draw a line from a node on one arc to a node on the other arc, as seen in Figure 3-4. You want this line to be exactly on the nodes, rather than merely close to them.

Bring up the *Draw* menu and pick the *Line* option (the keyboard shortcut is **[D][L]**). You could figure out from the specs what the start and end points of the line should be, and then you could type them into the data entry fields, but there is an easier way. Click on the word **Start**, as seen in Figure 3-4. The word will start blinking in a blue color. Then move the mouse into the drawing and put it on the node of one of the arcs, such as the node pointed to by the arrow in Figure 3-4. Notice that the mouse icon will change to show the word “Start Node” when it is on the node, as seen in Figure 3-5. If you see the word “Link” instead, that means you do not have the mouse on the node, in which case if you click the mouse button, you will get the wrong X-Y coordinates. The mouse icon must be displaying “Node”, “Start Node”, or “End Node” in order for you to be guaranteed that you are specifying the X-Y coordinate of the node.

After you see the word “Node” in the mouse icon, click the left button. MillWrite will fill in the **Start X** and **Y** data fields with the coordinates of the node, as seen in Figure 3-5.

If you click the wrong node, or if the mouse was not exactly on the node when you clicked it, just put the mouse on the correct node and click it again. It doesn't hurt anything to click it more than once. Rather, MillWrite just assumes you made a mistake with the previous click.

After you set the **Start X** and **Y** coordinates to one of the nodes (it doesn't matter which node), click the label **End Point**, as seen in Figure 3-6. The label will start blinking in blue. Then click the mouse on the **other** node of the other arc, as seen in Figure 3-6. MillWrite will draw a dotted line to show you what you are specifying.

The line is now complete, and MillWrite will show you the angle and length of the line in a

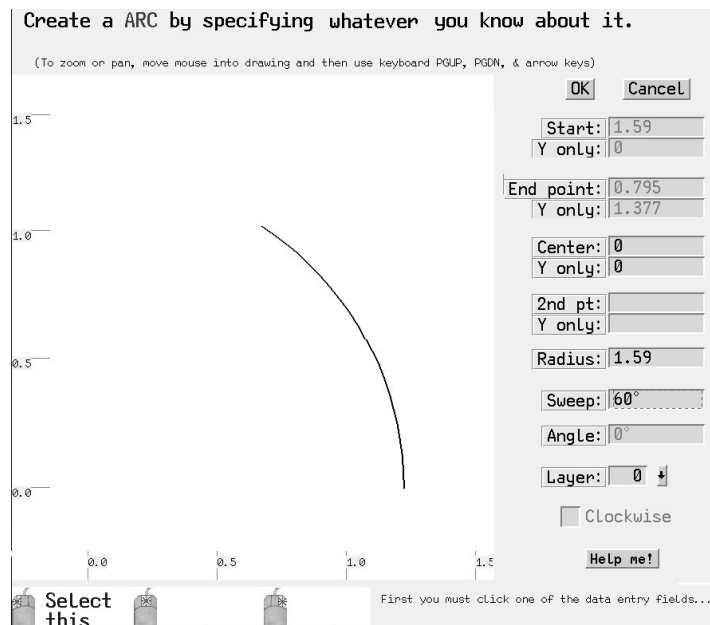


Figure 3-2

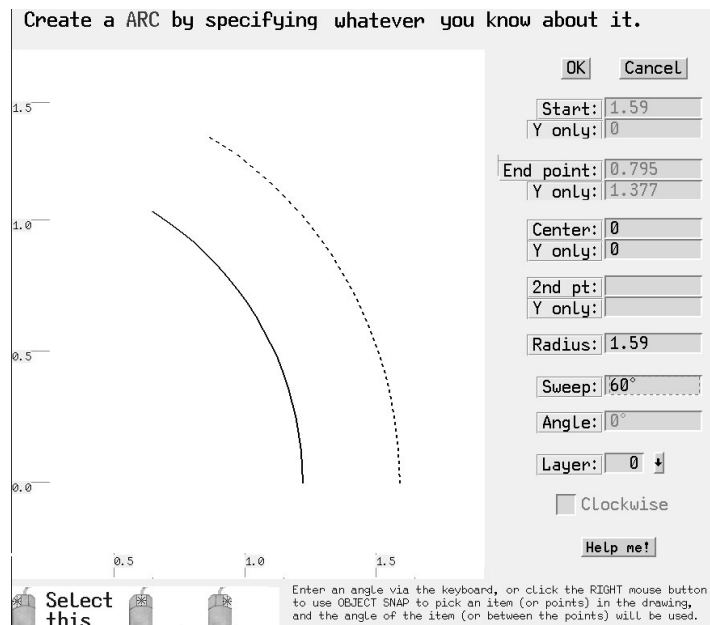


Figure 3-3

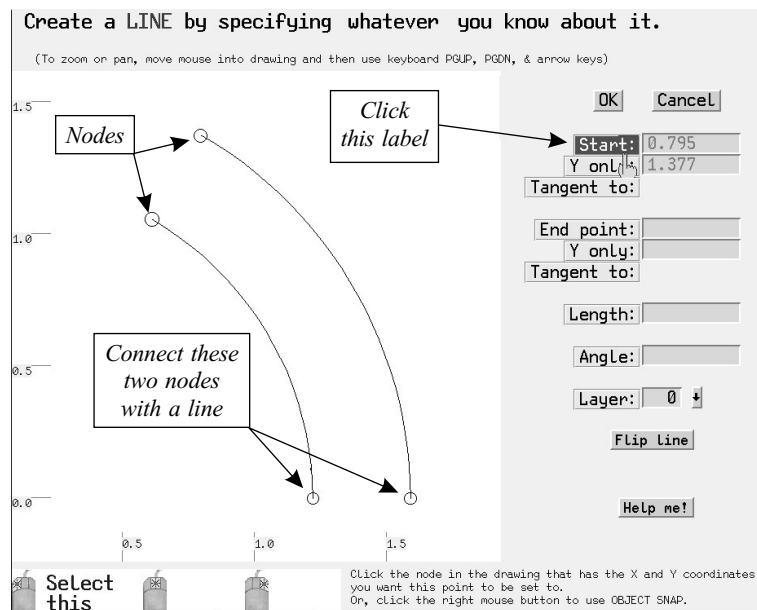


Figure 3-4

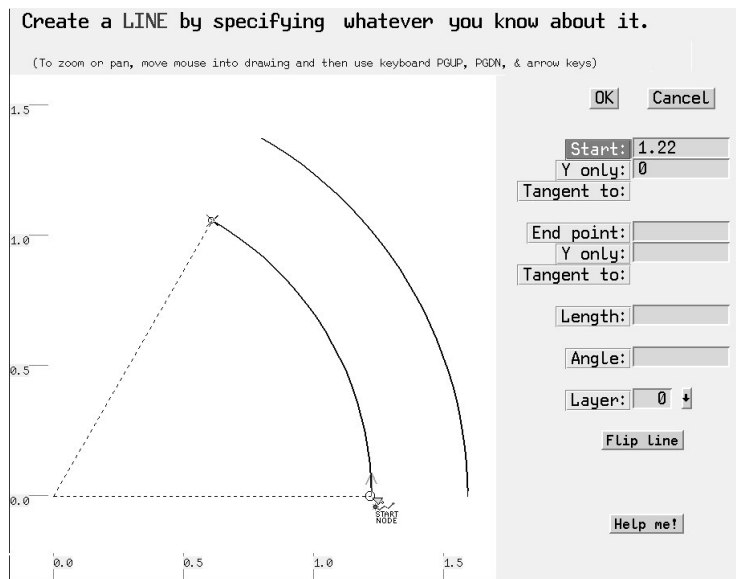


Figure 3-5

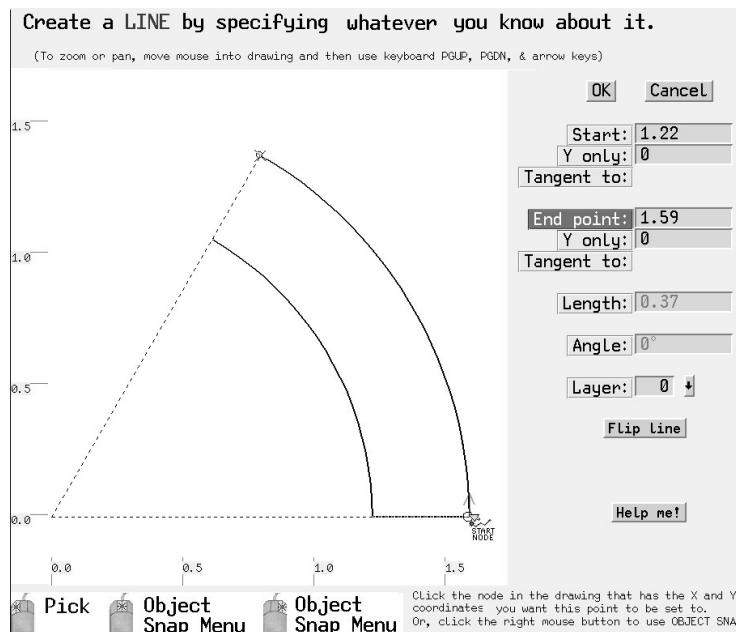


Figure 3-6

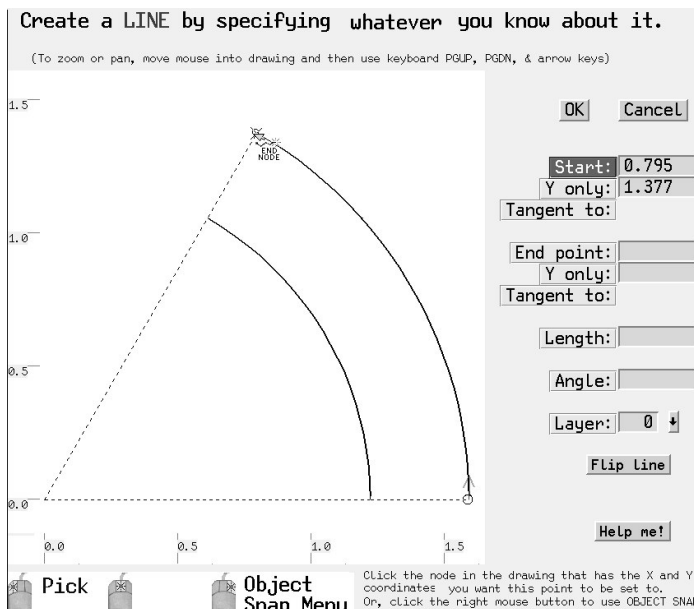


Figure 3-7

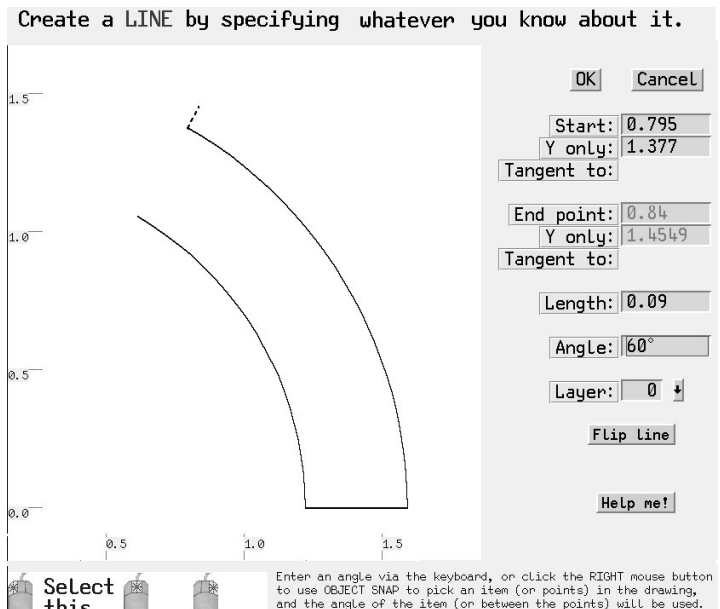


Figure 3-8

different color. If you specified this line correctly, you will see a length of .37 and an angle of either  $0^\circ$  or  $180^\circ$  (the angle depends on which node you picked to be the start of the line). You are finished with this line, so click OK to let MillWrite know you want to keep it.

#### STEP 4) DRAW ONE OF THE .09 LINES.

The line drawing function should still be showing, with most values empty. Referring to Figure 3-7, click the label **Start**. Then move the mouse to the *other* end of the large arc and click its node. This will set the start for the .09 line, but what do click to set the end of this line?

There is nothing to click to set the end node. However, the specs show the line has a length of .09, so move the cursor to the **Length** field and enter .09. MillWrite will draw a dotted horizontal line, and display the coordinates of the end point. However, that is *not* the end point you want, so ignore it. MillWrite is assuming the line has an angle of  $0^\circ$  since you didn't specify an angle.

According to the specs, this line is  $60^\circ$  counter-clockwise from the X axis. Since CAD systems measure angles counter-clockwise from the X axis, that means this line has an angle of  $60^\circ$ . So move the cursor bar down to the **Angle** field and enter 60. You will now see MillWrite display the correct line and end point for it (Figure 3-8). You are finished with this line, so click OK.

#### STEP 5) DRAW THE OTHER .09 LINE.

This is similar to step 4. Click the **Start** label and then click the other node on small, inner arc.

The only difficulty with this line is figuring out the angle MillWrite needs. MillWrite measures the angle of lines from the **start** of the line to its **end**. Therefore, this line will be in the opposite direction of the other line, which means this line is 180° from the other line. Since the other line has an angle of 60°, this line has an angle of 60° plus 180°, which is 240°. So enter 240 in the angle field. Your screen should look like that in Figure 3-9. Then click OK.

#### STEP 6) DRAW CONSTRUCTION LINES

You cannot use the **Draw** Line function to make the arrow head because the specs don't provide the length, angle, or end points for the lines. The only info the specs provide is that the tip of the arrow is .5 inches from those two .09 inch lines. So let's draw construction lines that are .5 inches from those two .09 inch lines. The easiest way to do this is to use the **Offset** command to make .5 inch offsets of each of the two .09 inch lines.

If the **Draw Line** function is still active, cancel it and move the mouse back into the drawing. Then start the **Offset** function, which you can find in the **Edit** menu, and the **Main** menu (which provides access to the **Edit** menu). Or, as the message in the lower right corner of the screen will remind you, just press the **[O]** key.

The screen changes when the **Offset** function starts (Figure 3-10). There is a data entry field on the screen where you specify the offset value, but you **don't** have to first click the field. MillWrite knows that if you type a value, you are specifying the offset. So just type .5 and press **Enter**.

Since you will be offsetting an individual line, it doesn't matter whether you pick a CAM or CAD offset, nor does it matter if you pick OFFSET INDIVIDUAL LINKS or OFFSET ENTIRE POLYLINES. No matter what you set these options to, the offset of an individual line will always be just another individual line. These options are important only when you offset *polylines*.

Before you continue, if you cannot clearly see the .09 lines, press the **[Page Up]** or **[Page Down]** keys to zoom in or out, and/or the keyboard arrow keys to move the image, to make the lines you are going to offset more easily visible.

Now touch the mouse to one of the .09 inch lines. The mouse icon will change to show the words **"Fixed Offset"**, (Figure 3-11) when you correctly put the mouse on the line. Then click the **left** mouse button.

The message on the top of the screen will then change. You will be asked to click on the side of the line you want to offset. All you have to do is click somewhere off to the left side of the line. MillWrite will then create the offset.

Now offset the other .09 line by clicking on it, and then clicking somewhere to its left. The screen should then look like Figure 3-12. You are finished offsetting both lines, so click the **Done** button in the upper left corner, or press the **[Esc]** key.

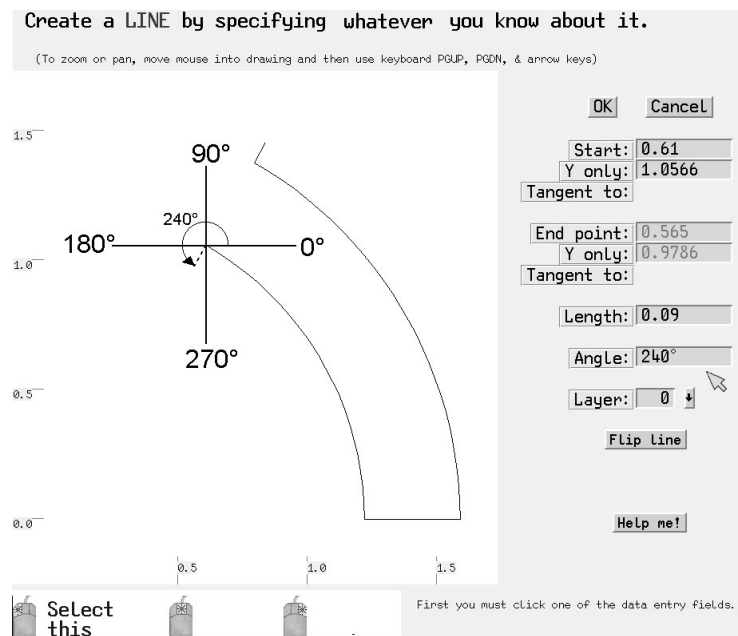


Figure 3-9

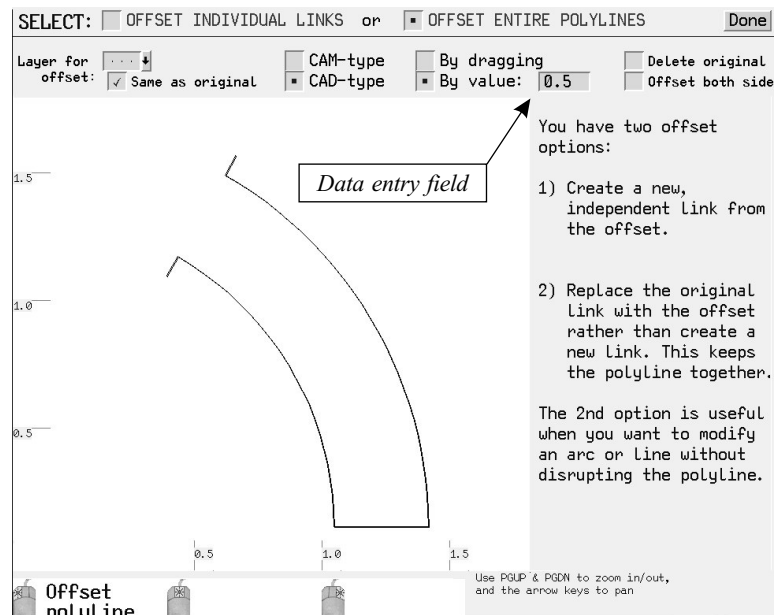


Figure 3-10

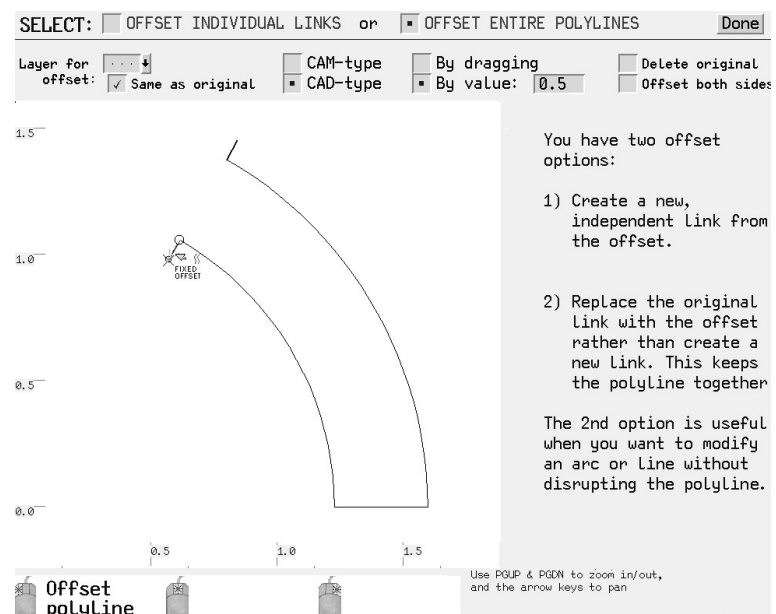


Figure 3-11

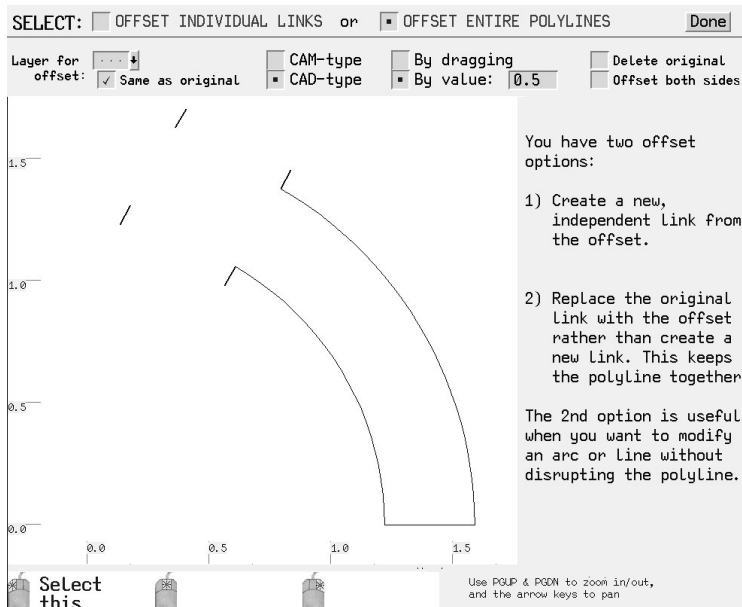


Figure 3-12

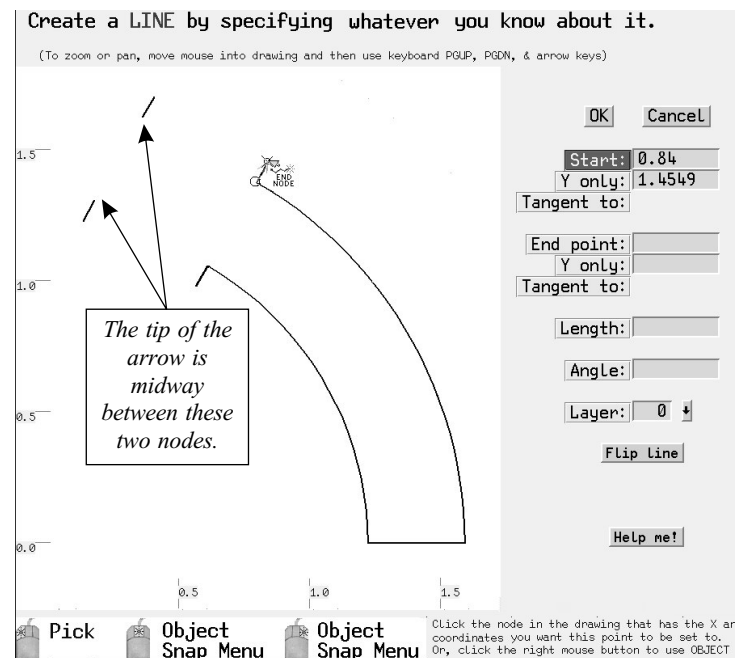


Figure 3-13

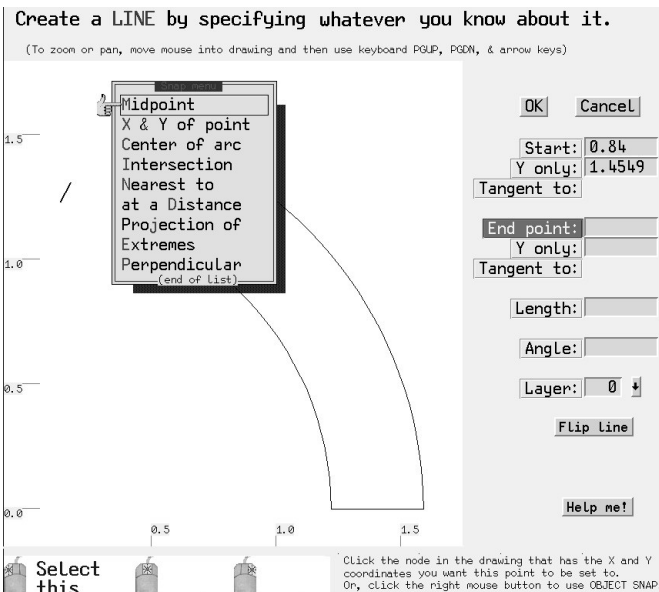


Figure 3-14

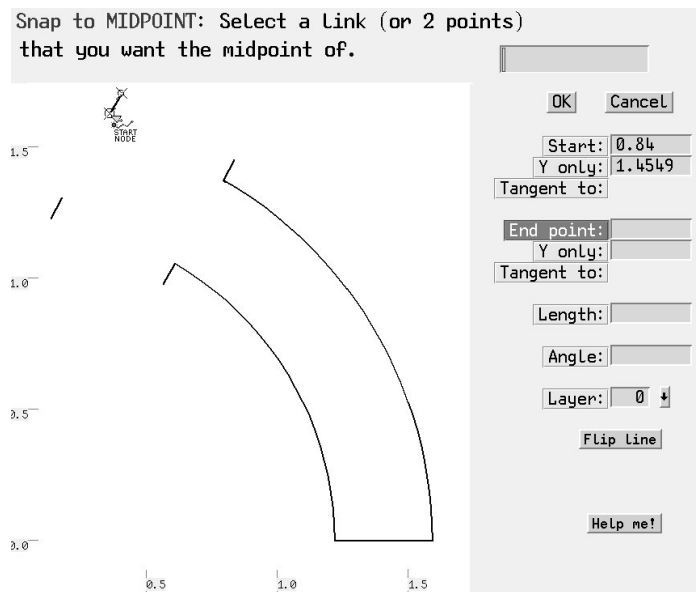


Figure 3-15

## STEP 7) DRAW USING OBJECT SNAP

Those two offsets are all you need to complete this arrow. The tip of the arrow is at the midpoint of those offset lines. So now you draw a line to that midpoint.

Click the **Draw** menu button and then pick the **Line** function. Click the label **Start**, and then click the end node of one of the .09 inch lines, as seen in Figure 3-13.

Now the situation gets tricky. The location you want for the end of the line doesn't have a node at that location, so you cannot click a node. The solution is to use **Object Snap**.

Notice that bottom right corner of the screen reminds you that you can click the **right** mouse button for the **Object Snap** functions. So click the **right** mouse button on the label **End point**. As seen in Figure 3-14, this turns the **End point** label blue, and the **Object Snap** menu appears near the center of the screen. Pick the **Midpoint** option.

The message at the top of the screen will change (Figure 3-15). You will be asked you pick a **link** or **two points**. In this case you will pick two points.

Move the mouse to the start node of one of the construction lines. As seen in Figure 3-15, the mouse icon changes to show the word **Start Node** when you have it on the start node. Click the **left** mouse button when you see **Start Node**.

The message at the top of the screen will then change to ask you to pick the 2nd point (Figure 3-16). Touch the start node of the other construction line with the mouse. You should see the mouse icon change to show "Start Node", as seen in Figure 3-16. Then click the **left** mouse button. You just specified the two points that you want MillWrite to calculate the

midpoint of. MillWrite will then draw the line to that midpoint.

Note that you could have picked the two **end** nodes of those construction lines rather than the two **start** nodes. But you couldn't pick the **start** node of one line and the **end** node of the other because that would have created the wrong midpoint.

#### STEP 8) COMPLETE THE ARROW HEAD

Drawing the last line of the arrow is easy; the start node of the line is already set for you, so all you have to do is click the **End point** label and then click the end node of the other .09 line. Click OK when finished, and then cancel the line drawing.

#### STEP 9) DELETE THE CONSTRUCTION LINES

Deleting a few individual items is easy; just touch one of them with the mouse and press the **Delete** key.

Another way is to touch any geometry with the mouse, click the **right** mouse button for the **Node Menu**, and pick the **Delete Item** option. In the case of individual lines, you could also pick **Delete Node** or **Delete Link**; all three functions will delete an individual line. After setting the mouse to one of the **Delete** functions, just click the **left** mouse button on each item.

If you have a lot of items to delete, it is easier to **select** all of them by drawing a window around them. This causes MillWrite to switch to the **Selection** mode. Then you can select more items, or un-select items that you accidentally selected. When finished selecting items, click the **Delete** button.

#### STEP 10) PUT A LINE ON TOP OF ANOTHER

The arrow is complete, but it consists of seven **individual** lines and arcs. As the next chapter will explain, it is usually best to use one **polyline** rather than individual lines and arcs.

MillWrite will automatically join all seven lines and arcs into one polyline if you set any of the lines or arcs to a CAM usage of "Spiral Pocket" or "Contour", but sometimes you will want to join items together by yourself, so you need to know how to do it.

The lines and arcs that make up arrow are easy to join together because all the lines and arcs form a closed loop without any overlapping or duplicate lines. Also, there is **no** gap between the lines and arcs.

The lines and arcs in this arrow would be more difficult to join together if you drew unnecessary lines on top of other lines, or if you had gaps between them. If you wonder why anybody would put unnecessary lines on top of other lines, just look at some DXF files that engineers pass to machinists. The engineers often lack an understanding of what a machinist needs, so when they create drawings they sometimes have lines on top of lines. They also sometimes have gaps between the items.

Furthermore, **you** may accidentally put lines on top of other lines when you get distracted or confused. Therefore, you should know how to recognize this particular problem. So, let's create a line on top of one of the other lines.

From the **Draw** menu, pick the **Line** function, and then set the **start** and **end** of this new line to the same start and end of one of the lines in the drawing. To do that, just click the label **Start**, and when you see it blinking in blue move the mouse into the drawing and click a node of the line that is identified in Figure 3-18. Then click the label **End Point**, and when you see it blinking in blue move the mouse into the drawing and click the other node of that same line. Then click OK, and cancel the line drawing function. You now have a line on top of another line, but you will **not** be able to see it by looking at the drawing.

#### STEP 11) USE **[Spacebar]** TO CHECK FOR DUPLICATE ITEMS

If you suspect a line (or arc) is on top of another line (or arc), you can quickly check for it by touching it with the mouse and looking at the lower right corner of the screen to see what the ID number of that item is, as in Figure 3-17. Then press the **[Spacebar]** or **[Tab]** key, which, as mentioned in Chapter 1, will force MillWrite to search for another item at that location. If there is a duplicate item, you will see the ID number change. You may also see the parameters on the right side of the screen change, if the other item has different parameters.

If you press the **[Spacebar]** or **[Tab]** key a third time and find a **third** ID number, that means there are **three** items on top of each other.

#### STEP 12) JOIN ITEMS INTO ONE Polyline

There are two ways to start the "Join items" function:

- Bring up the **Node Menu** and pick the **Join Items** function. Then click any of the lines or arcs that you want to join to other items.
- Touch one of the lines or arcs with the mouse and press **[J]** for the **Join** function, as the prompt at the bottom right corner reminds you (Figure 3-17.)

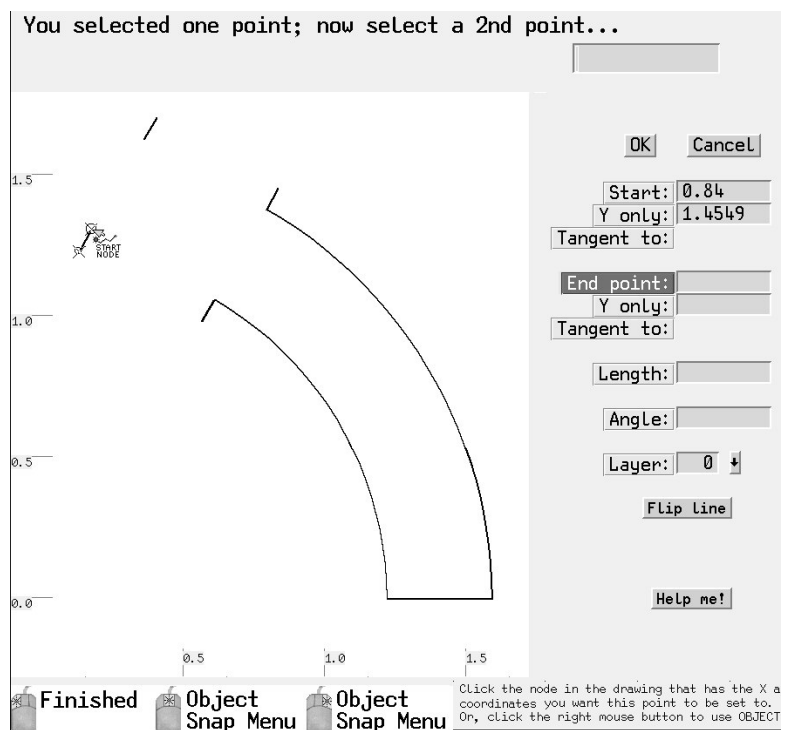


Figure 3-16

Pretend that you don't know there are two lines on top of each other in the arrow. Touch the line of the arrow head (the dotted line in Figure 3-18) with the mouse and press **J** for the **Join** function. The screen will change (Figure 3-18). The line you touched will be the item that the others are joined to. As you join items to it, the others become dotted also so that you can follow what is happening.

You have several options with the **Join** function, as you can see at the top of the screen. One option is **OK To Mix Layers**. This option is useful for drawing that have items on different layers. If you un-check this box, MillWrite will not join items unless they are both on the same layer.

If the **OK To Mix Layers** button is checked, you can restrict which layers can be mixed by entering the layer number in the two data fields below it. Since the layers are numbered, any item on a layer that is numerically between

the **Process From** layer and the **To** layer will be considered in the joining process.

Another option is **Max Gap**. This option is for drawings in which the items have gaps between them. In such a case, you can set a max gap, and if MillWrite finds two items are closer together than that gap, it will ignore the gap and join the items together.

However, these options don't apply to this arrow because all your lines and arcs are on the same layer, and they all touch without gaps. So you can ignore the options.

Now look at the mouse icons in the lower left corner (Figure 3-18). The functions are:

### Left button: *Join if Touching.*

If you click a line or arc with the **left** button, MillWrite will join it only if it is touching end to end with the arc. Items not touching are ignored.

### Middle button: *Join as is*

Clicking a line or arc with the **middle** button will join an item regardless of whether or not it is touching. If it is not touching, it becomes joined, but there will be a gap between it and the other links in the polyline chain. A situation where you would join items that do not touch is when you create logos or letters, or if you are creating the outline of the state of Michigan. Michigan has two separate sections that you might want to join so that they remain together.

### Right button: *Join with Line*

Clicking a line or arc with the **right** button will join items regardless of whether or not they touch. However, this button will create a line to connect them if they do not touch.

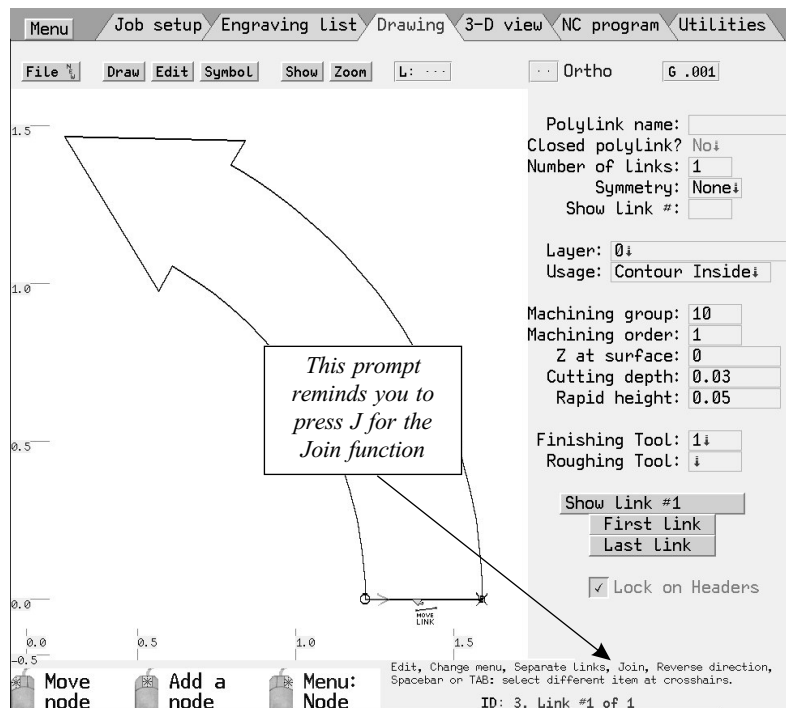


Figure 3-17

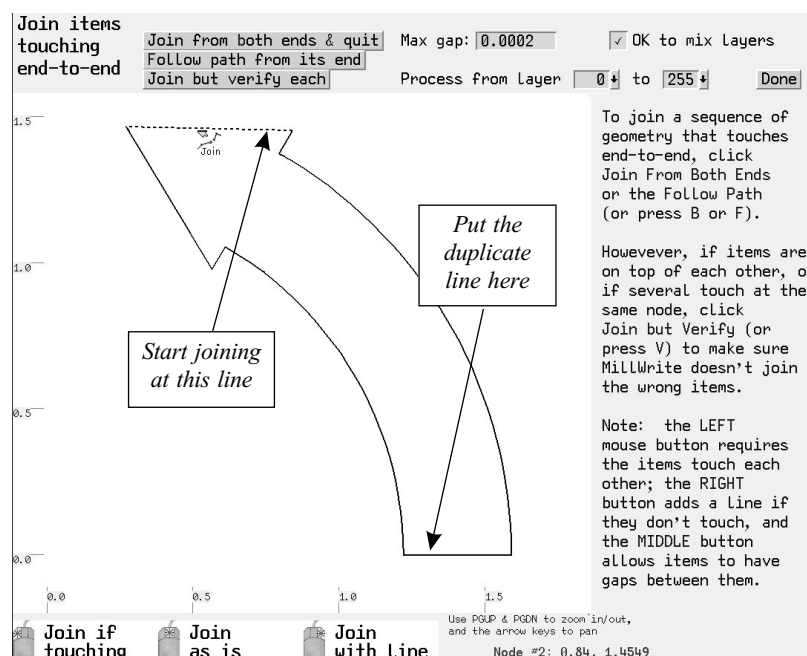


Figure 3-18

Now let's join the items.

The line that is dotted in Figure 3-18 is the line that the others will be joined to. To join items to it, you could click the **left** mouse button on each line and arc. As seen in Figure 3-18, the mouse icon changes to "Join" when you touch an item. But this is a slow method. A better method is to click one of the three functions at the top of the screen and let MillWrite figure out which items are touching end to end.

The three types of joining functions are:

### Join From Both Ends And Quit

This function will join all items touching either the start or end node. When MillWrite cannot find any more items touching end to end, it quits the join function and you return to the drawing.

## Follow Path From Its End

This function joins items only from the end node. Any items touching the start node are ignored.

## Join But Verify Each

This joins items from both the start and end node, but MillWrite asks for your approval before joining the items together. This function is useful when you want complete control over the joining process, or when you want to stop the process at a certain location.

For this simple example, click either the **Join from both ends** or the **Follow path** function (the keyboard shortcuts are B and F, as the message on the right side of the screen reminds you). Both functions will end up doing the exact same thing in this case because the arrow makes a closed loop.

However, there are two lines on top of each other, so when MillWrite encounters those two lines, it will not be sure which of them to join to the others. The screen will change, as seen in Figure 3-19. This *User's Manual* cannot show this, but MillWrite will cause the line to blink to show you which line it is asking you about. MillWrite wants to know if you want this line joined to the others.

At the top of the screen MillWrite is telling you that it found two items. If you want the blinking item to be joined to the others, press the **Enter** key. If you want to see the other item MillWrite found, press **Spacebar** or **Tab**. However, in this case, if you press the **Spacebar** you will see the **same** line blink because the two lines are exactly on top of each other. The only way you would realize that MillWrite is now blinking the **other** line is to look at the top of the screen. You will notice that the **ID number** of the blinking line has changed.

Now you see a symptom of lines on top of each other. To summarize, MillWrite will tell you that you have to make a choice between several items, but it will appear as if the same item blinks over and over.

Now pick one of the blinking lines to join to the others. MillWrite will join that line, and then it continues looking for items to join together. However, MillWrite will now notice that it has two possible paths to take; it can join the arc or it can join that unwanted line that you didn't want the previous time. So you will again be asked to make a decision between two items. However, this time it will be more obvious as to which item is which. When you press the **Spacebar** you will see the arc blink, and when you press it again you will see the line blink.

So a further annoyance of lines on top of each other is that MillWrite will encounter them twice, so you have to reject them two times.

## THE FASTEST WAY TO JOIN ITEMS

If your drawing is designed properly (ie, if it doesn't contain duplicate items) you can click the **Edit Menu** button, and then pick **Make Changes To Entire Drawing**, and then pick **Join Items**. MillWrite will then combine **all** items that touch each other. This will also give you the option to join items on a layer by layer basis, also.

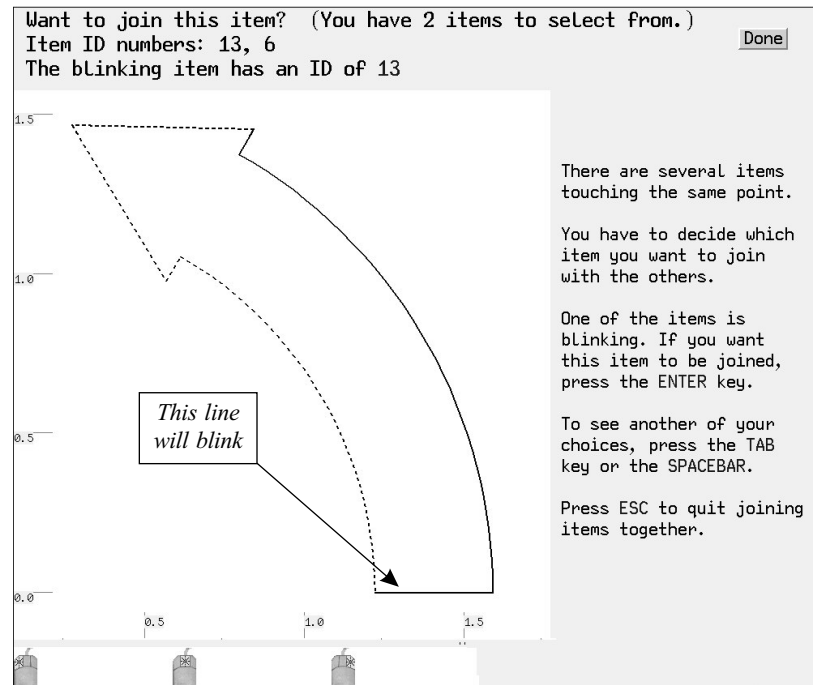


Figure 3-19

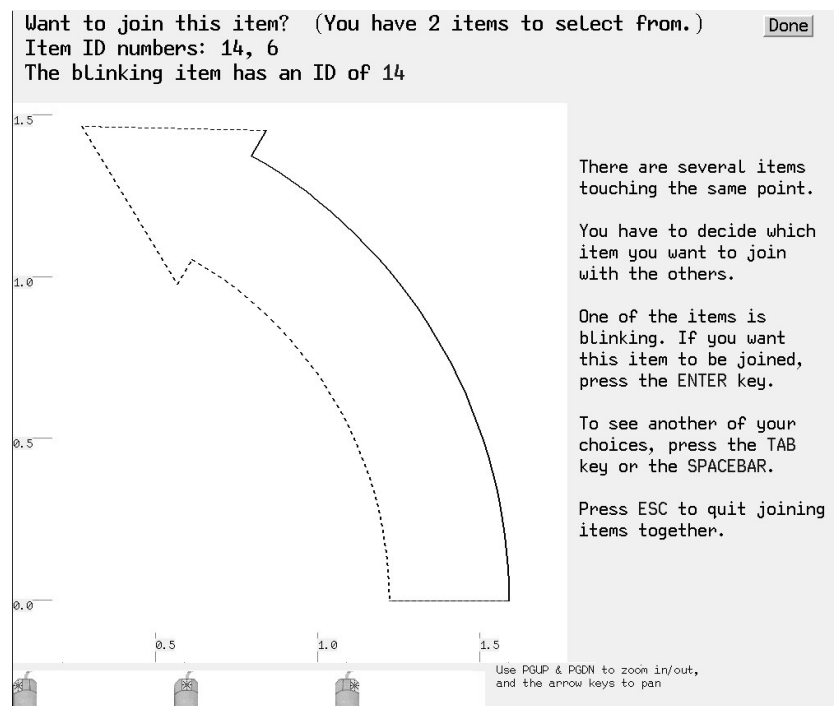


Figure 3-20