



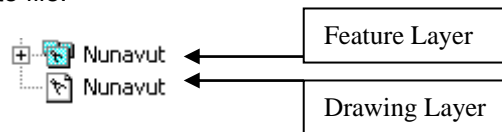
## Background Information

Frequently in the field of GIS you will need to work with data from different sources such as **CAD** (Computer Aided Design) files. These file types include **AutoCAD's .dwg** or **.dxf** files, or **MicroStation's .dgn** drawings. **ArcGIS** is designed to work with these files quite effectively and with relative ease.

The appearance of **CAD** files in **ArcMap** is similar to that of the vector based shapefile. Features are comprised of a combination of four layer types: point, line, polygon, and annotation.

When CAD files are created, the user can assign more than one layer type per file. In other words, instead of having each layer type stored as its own distinct file, the CAD files can store different layer types within the same file. When CAD operators create drawing files, they generally organize them so that each layer contains a type of object. For example, one layer might contain roads (lines), another might contain vegetation (polygons), a third layer might contain spot elevation samples (points), and a fourth layer may contain annotation (text).

When adding CAD files to a Data Frame you have the option of selecting a **CAD drawing layer** or a **CAD feature layer**. Your decision will depend on the intended use of the data. If you simply wish to use the data as a backdrop on which to overlay other features, then the **drawing layer** will suffice. However, if you wish to do more advanced spatial analysis and querying then you need to add the **CAD feature layer**. This layer reads the data as a collection of point, line, polygon, and annotation layers. The CAD feature layer appears as an expandable blue folder in your *Add Data dialog box*, whereas, the drawing layer is a single white file.



It is important to note that because CAD data is not native to ArcGIS, there may be some subtle differences in its portrayal in ArcGIS. However, in most instances, either the CAD feature layer or the CAD drawing layer will fulfill your GIS needs.

### Overview:

#### In this tutorial, you will learn:

- What is a CAD file
- How to bring a CAD file into ArcMap
- How to work with the layers of the CAD file
- How to export a CAD file to a shapefile in ArcMap
- How to build a personal geodatabase
- How to export a CAD file to a geodatabase using ArcToolbox


### Let's get started!

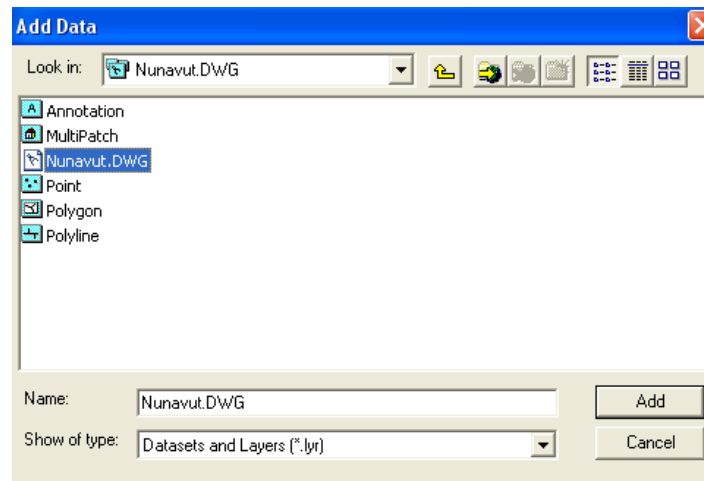


**Note:** To complete this exercise, you will need to download the dataset designed to be used in this tutorial. Download the data files by clicking either the **WinZip** or the **Self Extracting** link located just below this tutorial. The **Self Extracting** link will automatically extract the files to a folder called **CAD** on your **C:\ drive**.

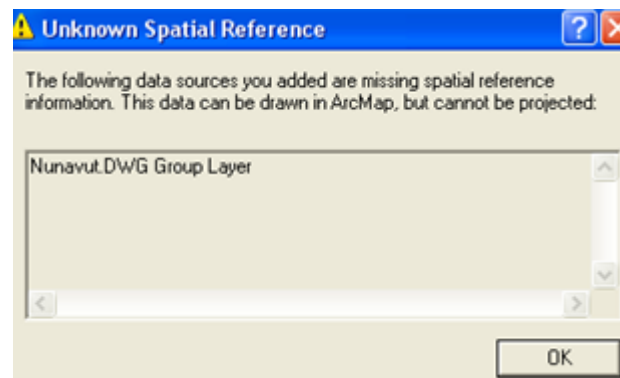
### Adding a CAD file to your Data Frame in ArcMap

Adding a CAD file to your data frame in ArcMap is even easier in ArcGIS 8.x/9.x than it was in ArcView 3.x. It is no longer necessary to enable a CAD Reader extension. CAD files can be added the same way you add a shapefile, without any reformatting.

1. Open **ArcMap**. Choose **A new empty map**, put a check mark in the **Immediately add data** box, and click **OK**.
2. First, browse to the **CAD** folder (C:\CAD). Double click on the **Nunavut.DWG** file and select  Nunavut.DWG (white symbol). Click **Add**.





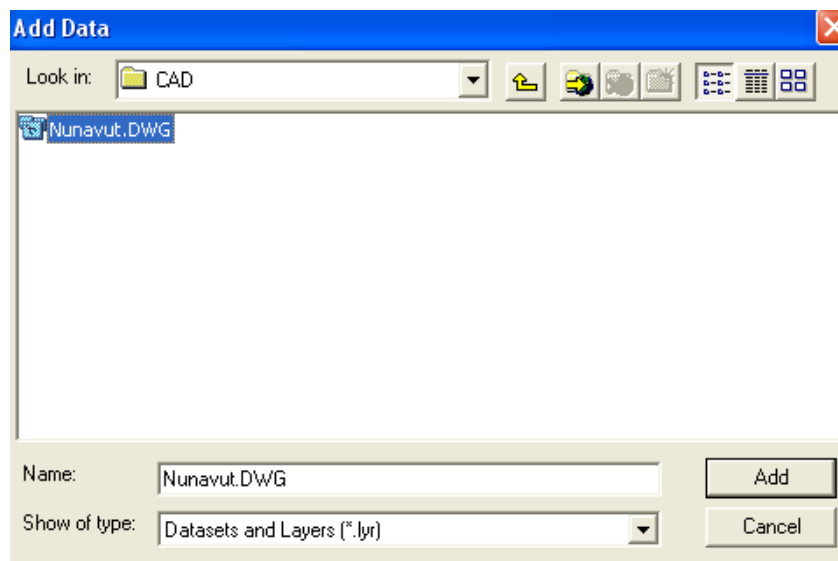
3. Click **OK** when the Unknown Spatial Reference dialog appears.




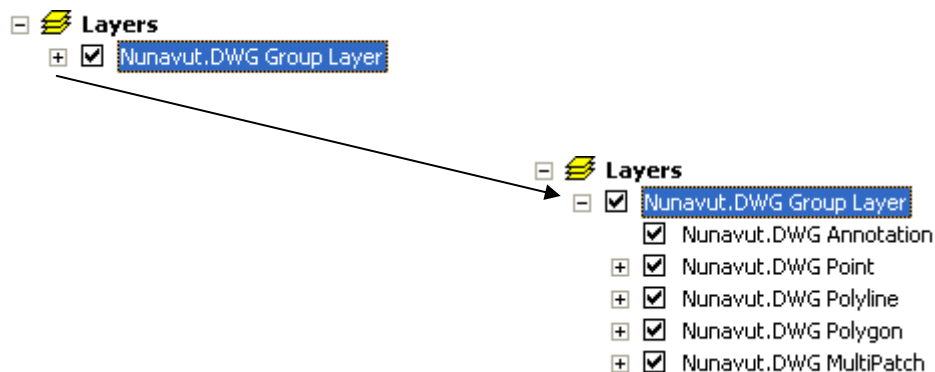


**Examining the drawing layer:** Notice that all the layers (polygons, lines, points and annotation) appear together as one file in the *table of contents*. As stated earlier in the background information, the drawing layer is basic and limited in terms of its functionality. It's mainly used as a display layer or background upon which other layers are overlaid. Double click on the layer in the *table of contents* to bring up the **Layer Properties** dialog box. The individual layers can be turned on and off by selecting the **Drawing Layers** tab and unchecking any of the layers that you do not wish to view. Click **Apply** to preview your results. Experiment with different layer combinations and click **OK** when you are satisfied. The drawing layer contains no associated attribute information, so it is not possible to perform queries on this layer.

4. Delete the **Nunavut.DWG** layer by right clicking on it in the *table of contents* and selecting **Remove**.
5. Click on the **Add Data** icon  and browse to the **Nunavut.DWG** feature layer. (**Hint:** The feature layer is the expandable blue folder .) Select it and click **Add**.




6. Click on the  to expand the file in the *table of contents*. You should now see the layers for that file.

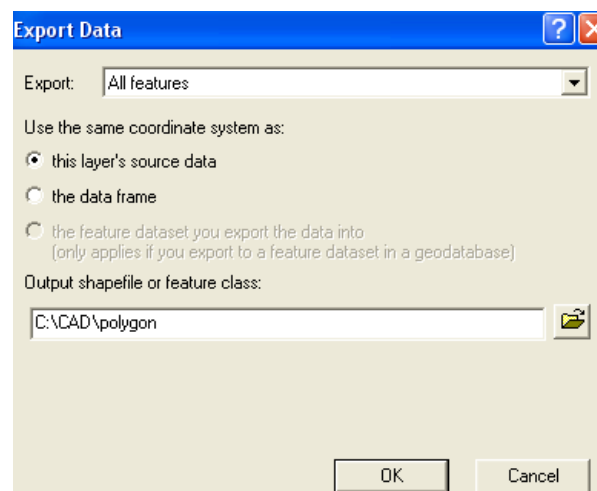




Examine these layers. Notice that these CAD layers function in much the same way as shapefiles in ArcMap. You can turn the layers on and off by checking or unchecking the box beside the layer in the *table of contents*. You can open the associated **attribute table** by right clicking on the layer and selecting **Open Attribute Table** and you can change the symbology by clicking on the layer symbol to bring up the **Symbol Selector**.

### Exporting a CAD file to a shapefile in ArcMap

1. Right click on the **Nunavut.DWG Polygon** layer in the *table of contents*. Select **Data** and **Export Data**.
2. In the **Export Data** dialog box click on the Browse button  and navigate to the CAD folder or the directory you are using for this exercise. Rename the file **polygon** and click **OK**.



3. Click **Yes** to add the exported data to the map. You have now successfully exported a CAD file to a shapefile in ArcMap.
4. Uncheck  the **Nunavut.DWG Group Layer** in the *table of contents*.

- Nunavut.DWG Group Layer
  - Nunavut.DWG Annotation
  - Nunavut.DWG Point
  - Nunavut.DWG Polyline
  - Nunavut.DWG Polygon
  - Nunavut.DWG MultiPatch

**Note:** Notice how similar the newly exported shapefile is to the CAD layer from which it was exported from. The attribute tables are virtually identical and the polygons match up perfectly. Remember, it may not be essential to convert your data in order to work with it. A lot of core ArcGIS functionality can be conducted on CAD data without conversion. Setting the spatial reference, spatial joins, and relates, and geoprocessing/buffering are all examples of common functions in ArcMap that can be performed on CAD data.



## Introduction to the Geodatabase

### Background Information

Definition: A geodatabase is a relational database that stores GIS data as a collection of tables.

Put simply, a geodatabase is a tool for managing geographic data. The advantage of geodatabases is that they can contain a number of different file types. The geodatabase allows separate files, which would otherwise act independently of one another, to be administered together. Another advantage of the geodatabase is that it can store a wide variety of relational data such as topological associations, georeferencing information, and user defined validation rules. There are two principle methods for organizing data in a geodatabase. Data can be sorted into feature classes or feature datasets.


**Feature Classes** are tables that have a common geometric attribute such as points, lines, or polygons. There are also two other types of specialty feature classes: in ArcView 9.x an annotation layer can be a feature class and dimension data can be stored as a feature class.

**Additional Information:** Annotation feature classes specialize in storing strictly text in the geodatabase. The exact location of the text is also stored, so the position of the text does not change when you alter the scale of a data frame (unlike with labels). Dimension feature classes specialize in storing measurement data. Typically, dimension data consists of some basic symbology, such as an arrow, and some text that lists the length of a line feature. ← 23.5 →

**Feature Datasets** are containers for feature classes. The common denominator for all feature classes in a feature dataset is that they have the same **spatial reference information** (projection, coordinate system, and coordinate domains). Feature datasets are useful for managing topological relationships between feature classes and for data organization.

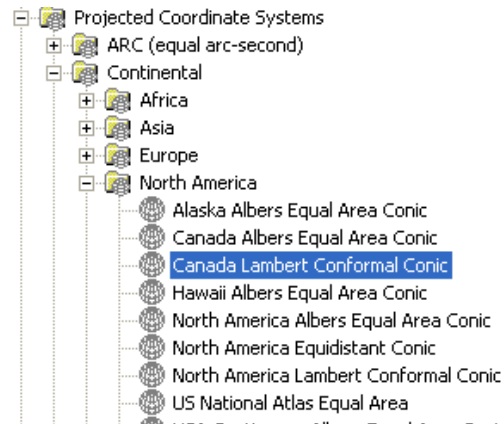
**Geodatabases** can be administered at two different levels. **Personal Geodatabases** are created and administered by a single user and **Enterprise Geodatabases** can be edited by multiple users simultaneously. Personal Geodatabases can be created and managed using standard ArcGIS Desktop technology; whereas, Enterprise Geodatabases require ArcSDE to be installed on a server. This tutorial will strictly deal with geodatabases created in ArcView.

### Creating a personal geodatabase in ArcCatalog

1. Open **ArcCatalog**.
2. Right click on your **CAD** folder in the catalog tree and select **New** → **Personal Geodatabase**. (You are creating a destination geodatabase to send your CAD drawing to.)
3. Name the geodatabase **CAD\_Drawing**.  CAD\_Drawing
4. Now you are going to create a **Feature Dataset** in your geodatabase to manage your CAD data. To do this, right click on your personal geodatabase called CAD\_Drawing and select **New** → **Feature Dataset**. Type in **Nunavut** for the name of the feature dataset and click Next.



- You will now assign a coordinate system. Click the **+** sign next to **Projected Coordinate Systems** → **Continental** → **North America** → **Canada Lambert Conformal Conic**.

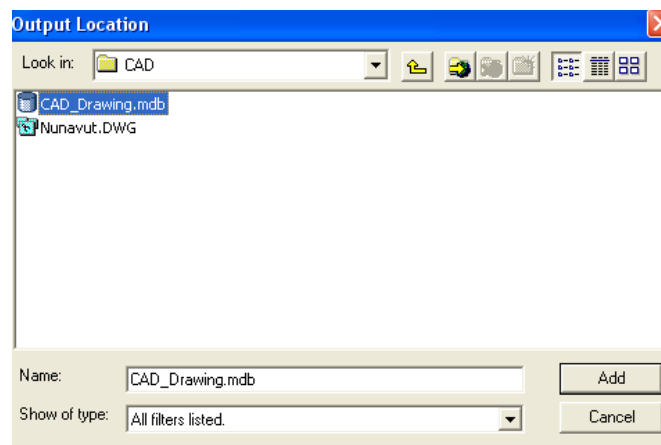


- Click **Next** in the following two screen and **Finish**.
- On the Catalog tree (left side of the screen), make sure the feature layer of your **Nunavut.DWG CAD** drawing (not feature dataset) is expanded so that you can see each layer. If it is not expanded double click on it or click the + sign.



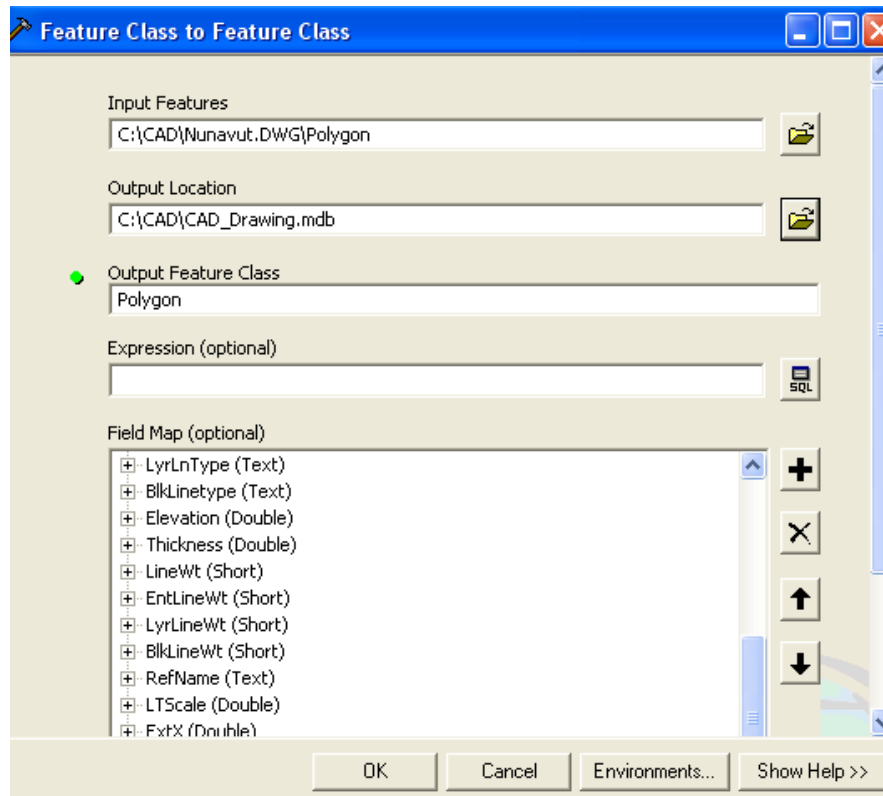
You are going to separately export each CAD layer to the geodatabase including the annotation layer.

- Start by right clicking on the **Polygon** layer in your expanded **Nunavut.DWG CAD** drawing. Choose **Export** → **To Geodatabase (single)**...
- In the resulting **Feature Class to Feature Class** dialog box for the **Output Location**, browse to the **Nunavut** feature dataset in the **CAD\_Drawing geodatabase** that you created and click **Add**.



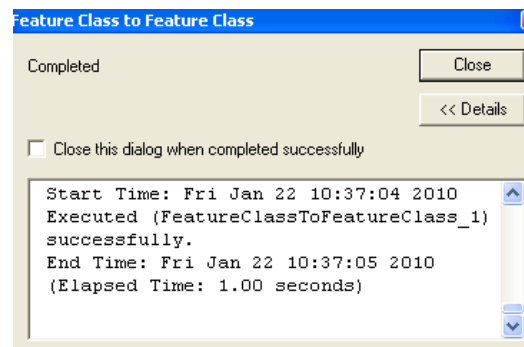



8. Type `Polygon` for the **Output Feature Class** and click **OK**.

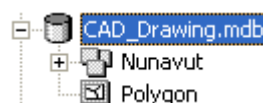


This will execute the conversion and a results dialog box should inform you that your task was completed successfully.

9. **Close** the dialog box that appears.

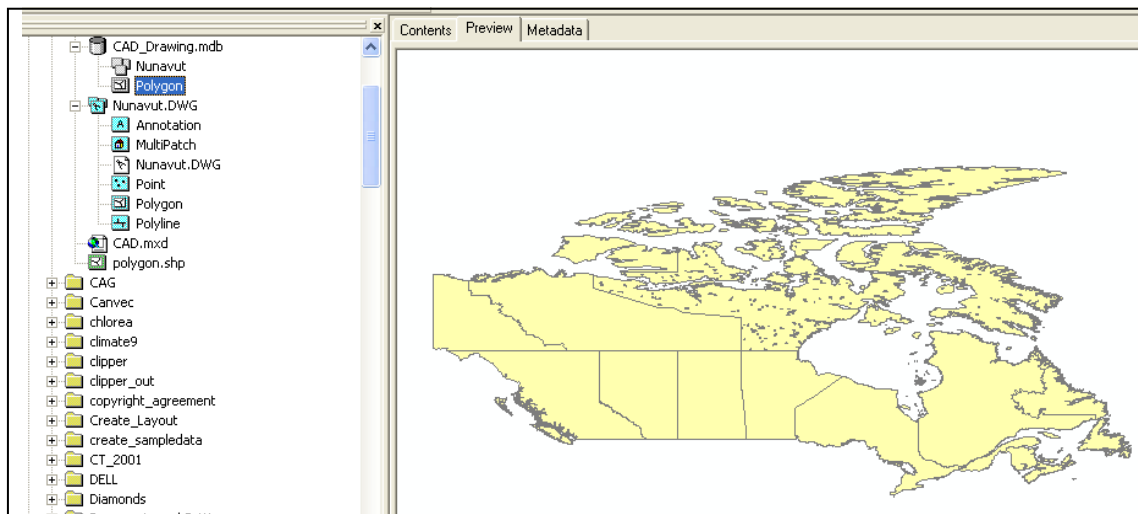


10. **Double click** on the  `CAD_Drawing.mdb` (left side of the screen) to view the datasets.





11. Click on the **Polygon** layer and then click on the **Preview** tab (right side of screen). You should see all of Canada drawn as polygons.

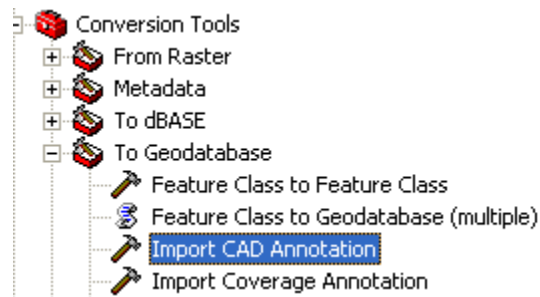


12. Once you've successfully exported the polygon layer, then you can export the point and line layers using the same procedure.

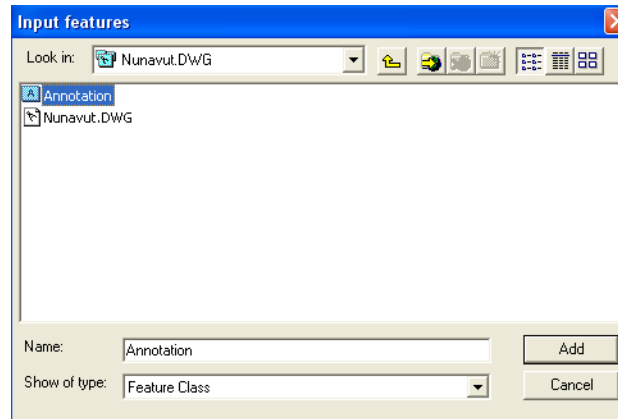
CAD annotation can be imported into a geodatabase as a feature class using **ArcToolbox**.

13. Click on the **ArcToolbox** icon  in ArcCatalog if ArcToolbox is not already open.

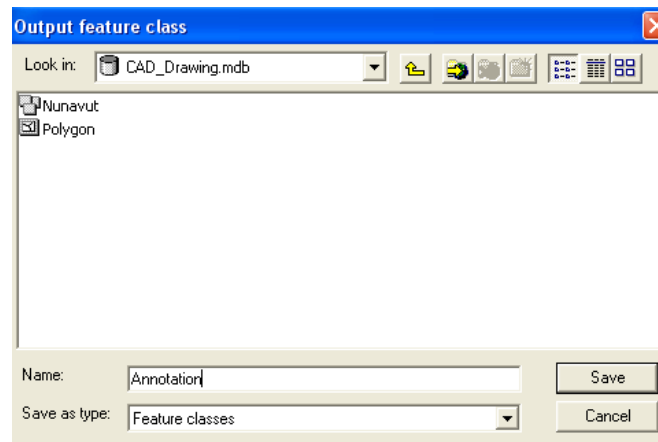
14. Expand the **Conversion Tools** and the **To Geodatabase** tools. You are going to use the  **Import CAD Annotation** tool.



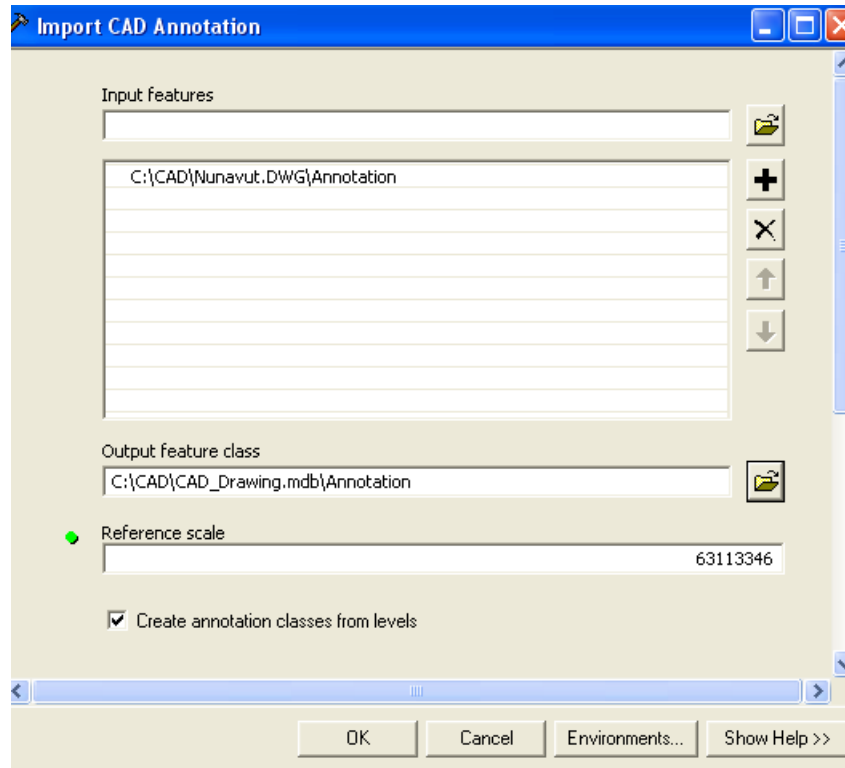
15. Double click on the tool to open the **Import CAD Annotation** dialog box. For the **Input Features**, browse to your **Nunavut.DWG** CAD annotation layer and click **Add**.



16. For the **Output feature class**, browse to your Nunavut feature dataset and type in `Annotation` for the feature name.



17. A reference scale is also necessary for the importation of CAD annotation. Use 63,113,346 as the reference scale (see screenshot on following page). This is the default scale for the annotation when you open it in ArcMap. Click **OK** once all these steps are complete to execute the import.



18. A results dialog box should tell you that your import was successful. **Close** the results box and double check by opening your **Nunavut** feature dataset.
19. Click on the **Annotation** layer that you imported so that it is highlighted in blue and then click on the **Preview** tab to view the annotation. Use the zoom tools to view it more closely.

Congratulations! You have now successfully created your own spatially referenced personal geodatabase and loaded it with CAD data.