How to georeference images in ArcMap (Arcinfo, ArcReader, ArcView)

This procedure outlines the steps required to georeference any image, including air photos or raster copies of scanned paper maps. In this example we will be using a scanned 1913 Fire Insurance Plan.

Note: It is imperative that you use high-quality resolution images for this process if the rectified images are going to be used in future projects. However, if the images are only georeferenced in order to vectorize the information, the resolution issue is not as important.

Procedure:

1) Open ArcMap, add the layers (roads, air photos, etc.) from which you will be using to georeference your images with the "Add Data" option. Load the image to be georeferenced like you would any other layer using the "Add Data" option.
You will notice that your image does not overlay on top of your GIS layers. In order to georeference the image, you need to overlay it on top of your GIS data.
2) To overlay the image, right click on the main task bar and select both the "Georeferencing" and "Effects" options
3) Using the "Georeferencing" task bar, select the image you want to georeference with the "Layer" option.

4) Select "Auto-Adjust"  
5) Click "Fit to Display".  
Automatically, your image will appear on top of your GIS layers.
6) Using the "Adjust Transparency" option of your "Effects" task bar, select a level that will enable you to view bottom layers underneath your image.
7) Using the Georeferencing task bar, select the "Add Control Points" option

8) Select a point on your image by clicking once on it (A green cross will appear). Drag the line from the green cross and find the equivalent spot on your GIS layer. Click on the selected point. A red cross will appear.
9) Continue adding control points until your image moves into place geographically.

The image below has automatically warped into its location after two selections. In most cases, several more control points should be added for better accuracy.
10) If you need to edit, save, or delete your control points, use the "view link table" on the georeferencing task bar.

Each line represents the control point locations. Each entry can be edited by highlighting the coordinate lines. Click on "Save..." to save the points in a text file and "Load..." to bring in a table of control points saved in a saved file. You can also delete a control point by simply hitting the delete key.
11) Once your image has moved to the location where you want it to be, you must rectify your image to "warp" it permanently into this location. By adding the control points to the original image, we are only temporarily creating this view of it. Warping it creates a duplicate of what you see on the screen and allows you to use that duplicate in any GIS. To warp the image, select "Rectify..." from the Georeferencing task bar.

12) Select a "Resample Type" for your image. All three options result in some resolution loss, but the cubic convolution option seems to lose the least.

13) Click on the folder option to give your new image a name, location, and format.
The default format is ESRI GRID, but TIF, and ERDAS are also options.

14) When saving in GRID format, you'll notice a folder with the name you just gave your new image. If saving in TIF, you will notice two files which you will need to use in a GIS. These will be the TIF file itself, and the world file with the same name but with a *.tfw extension. In ERDAS format, two files will be created, an *.img raster file, along with an *.iwg world file. A world file contains the information telling your software where to place the pixels for the corresponding image. The following is an example of the data found in a world file:

0.00000099999999998771970
0.0
0.0
-0.00000099999999998771970
-79.400039925169722
43.674976657316684
15) Once your new images have been created, you can then use them the same way you use your other GIS layers.