Georeferencing an Image in ArcGIS 9.x

The process of georeferencing an image involves matching locations on the unregistered image with real-world locations in your GIS by adding links, also called control points.

These seven guidelines will help you georeference an image.

1. Open the Georeferencing toolbar
2. Turn Auto Adjust OFF
3. Manipulate the display so you can see both the bad image and the correct layers
4. Add at least 2 control points
5. Turn on Auto Adjust
6. Check the RMS error and add/delete points as necessary
7. When you are satisfied with the registration, use Update Georeferencing to permanently register the image.

We’ll go over them in a bit more detail.

Open the Georeferencing Toolbar
Georeferencing is done via the georeferencing toolbar. Open the toolbar by choosing View > Toolbars > Georeferencing.

Turn Auto-Adjust off
This is helpful, because it means you can choose your initial control points without having your image try to shrink and shift immediately, which can sometimes make it difficult to work with. Setting up a couple of good control points first will make it easier to complete.
Manipulate the display so you can see both layers
In order to pick your control points, you need to be able to see both your good data and your data that you are going to georeference. This can be accomplished in a number of ways.

- Use the **Fit to Display** option and then set one layer with a transparency so that you can see the other data underneath it.
- **Zoom to Layer** back and forth between your good and bad data.
- Take a snapshot of one layer and set your display extent to the other data. To take a good snapshot, use a magnifier window and set its zoom to 100%.

Add at least 2 control points
Find some easily identified points in your data to use as control points; for example, an intersection of roads, or a particular well location. When adding a control point, always click the location on your “bad” data first, and then click the location on your good data. Think of it like telling ArcMap “**This** spot on my bad data should match **this** spot on my good data”. Make sure you choose control points that are spread out. It’s nice to choose some spots that are catty-corner to each other.
**Turn on Auto Adjust**
Once you have at least two control points set, it’s time to turn Auto Adjust back on and let ArcMap work its magic. Your image should shift/shrink/stretch to fit the spot you’ve specified.

**Check the RMS error and add/delete points as necessary**
Once auto-adjust is on, you can add more control points in any areas where the fit is not good. Once you have four control points, you will be able to see the residual error in your link table. For best results, your residual error should be as close to one map unit as possible. Delete the control points with larger residual errors and add new ones to make it a better fit. Keep in mind that this equation ArcMap is doing changes less and less with each new control point, so it’s better to have 5-8 control points than 15-20.

**Permanently register your image**
Once you are satisfied with your results, you can permanently register your image so it is already georeferenced next time you wish to use it. If you have write access to this image, you can choose Update Georeferencing from the Georeferencing drop-down menu. This saves the spatial information directly into your raster image. Make sure you only do this after you are completely satisfied with your results! Adding more control points after updating georeferencing will NOT WORK! You can also choose to Rectify, which will save your image as a new TIFF or ArcInfo GRID. This means your original image has not changed, and you should be able to add more control points as necessary. Keep in mind that Rectifying might take a while to complete, and rectify may change your colormap. Rectify is normally used to output to a TIFF that can be read, as a georeferenced image, in other software.