

# How to Align a Non-Georeferenced Image to an Existing Geographic Layer or Georeferenced Image

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You can align, or georeference, scanned maps to existing GIS data so that you can digitize information from them or use them as visual displays in your maps. For example, if you have a planimetric map of an area showing contour lines, building footprints, and curb lines, you can scan that map and georeference it in ArcMap, then digitize those features to create new GIS layers. Or you could scan an historical map or aerial photo to show change through time when compared with current orthophotos.

Prior to doing this, you need to carefully examine the digital image to be georeferenced and compare it with your GIS data. You should determine in advance what points will be your control points - that is, points that you can find on both the digital image and on your GIS data layers. These will act to align the image to the data. It is important to record these points ahead of time to help guide you in the georeferencing process.

You should have control points evenly distributed around the image, for example one at each corner and one in the middle; or several around each side and several more in the middle.

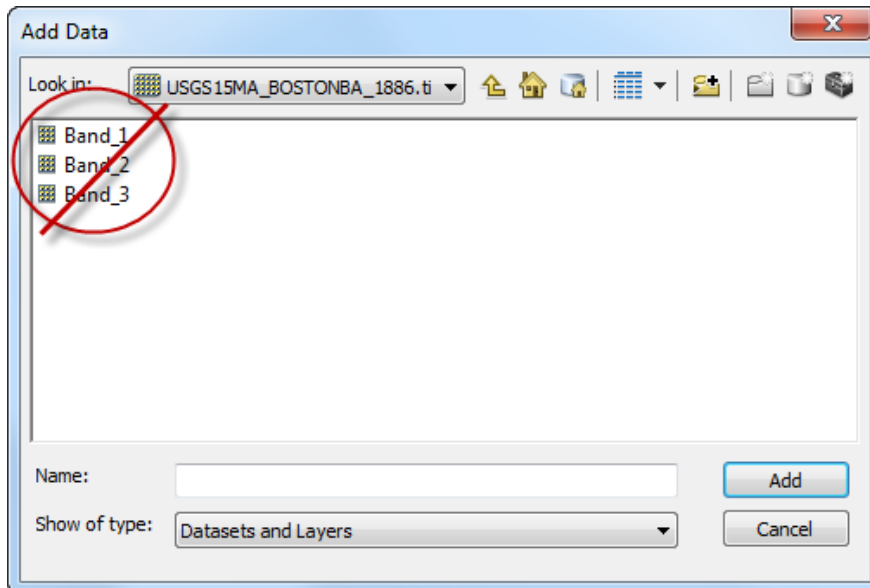
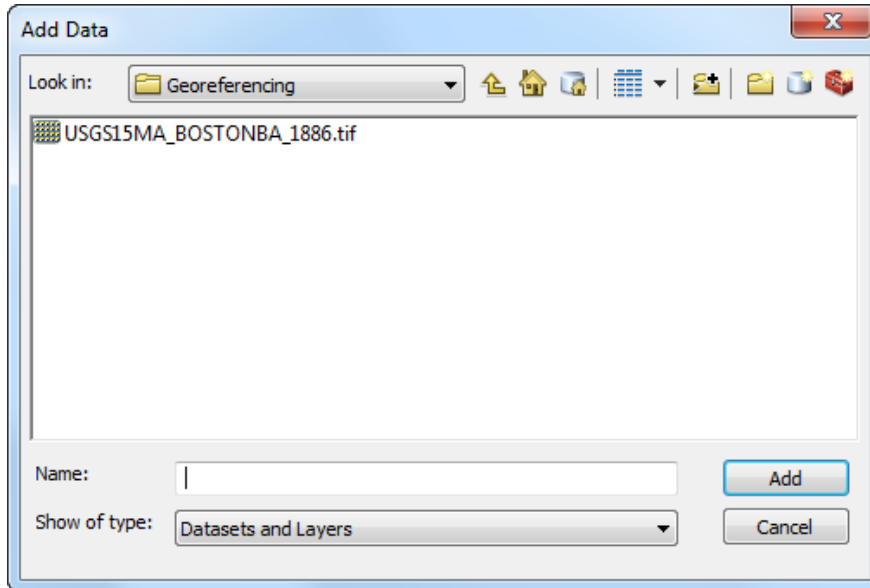
You can read more about this process by clicking on the **ArcGIS Desktop Help** menu within ArcGIS, and then going to **Contents- Professional Library –Data Management – Geographic Data Types—Rasters and Images—Processing and Analyzing Raster Data—Georeferencing--Fundamentals for Georeferencing a Raster Data Set**

## Georeferencing A Data Set

1. In ArcMap, add the existing shape file or the geo-referenced image that you are going to reference the new image against. Alternately, if you are in the Tufts GIS Lab, go to M:\State\MA\MassGIS\Political\_Boundaries and add the OUTLINE\_ARC.shp and TOWNS\_POLY.shp Files .
2. Activate the **Georeferencing** toolbar (**Customize -Toolbars – Georeferencing**)
3. Add the image layer which you want to georeference. If you've added the MASSGIS Layers, you can obtain the [map image](#) from the tip sheets page

(<https://wikis.uit.tufts.edu/confluence/display/GISatTufts/Tufts+GIS+Tip+Sheets+ArcGIS10>)

- Note that if it is a .jpg or .tif file, make sure you choose the entire image file (first below). If you double click on the file and see the individual bands listed in the dialog box (second right), you have drilled down too far. Back up and add the full .jpg or .tif file. When asked whether to *Build Pyramid*, click no, and click okay if you receive an “unknown spatial reference” warning.

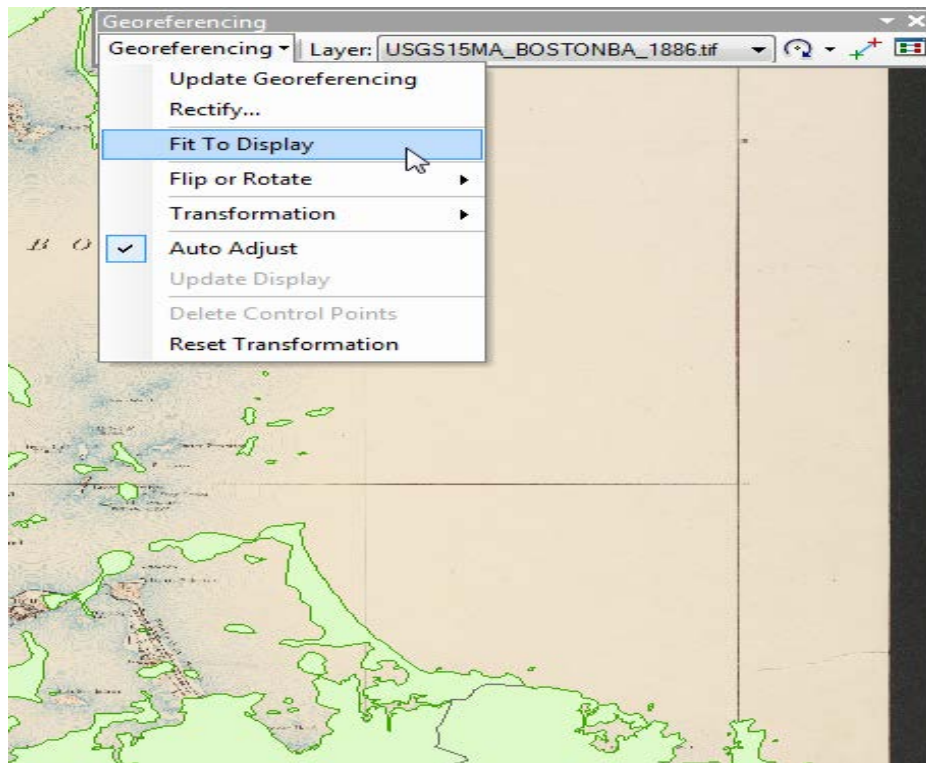


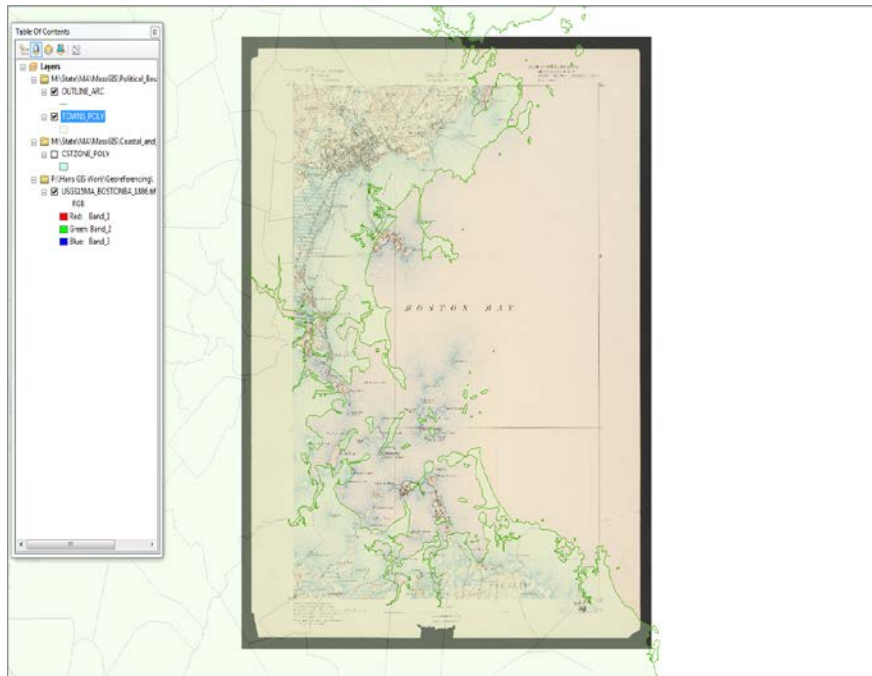
- Zoom in to the area of your shapefile that corresponds to the area of the image - this is not necessary but extremely helpful. If you need to look at the image to see what area it covers, right-click on the image in the table of contents and


choose **Zoom to Layer**, then go back to your previous view of your shape file and adjust the view of your GIS layers so that it displays approximately the same area. If you are using the Tufts' data, the area is the town of Lynn MA.

6. On the **Georeferencing** menu, make sure that your **Layer** specified is the image you want to georeference
7. From the **Georeferencing** toolbar, choose **Fit to Display** - the new image should fill the screen. You should see the overlapping layers, and you may want to make your shapefile data layer is transparent or make the features hollow, so that you can see both the un-georeferenced image and the georeferenced shapefile.



**Note:** In cases of the image becoming extremely warped during georeferencing, try the procedure again but turning the auto-adjust off. This allows the image to be adjusted at the end of the placement of all control points.

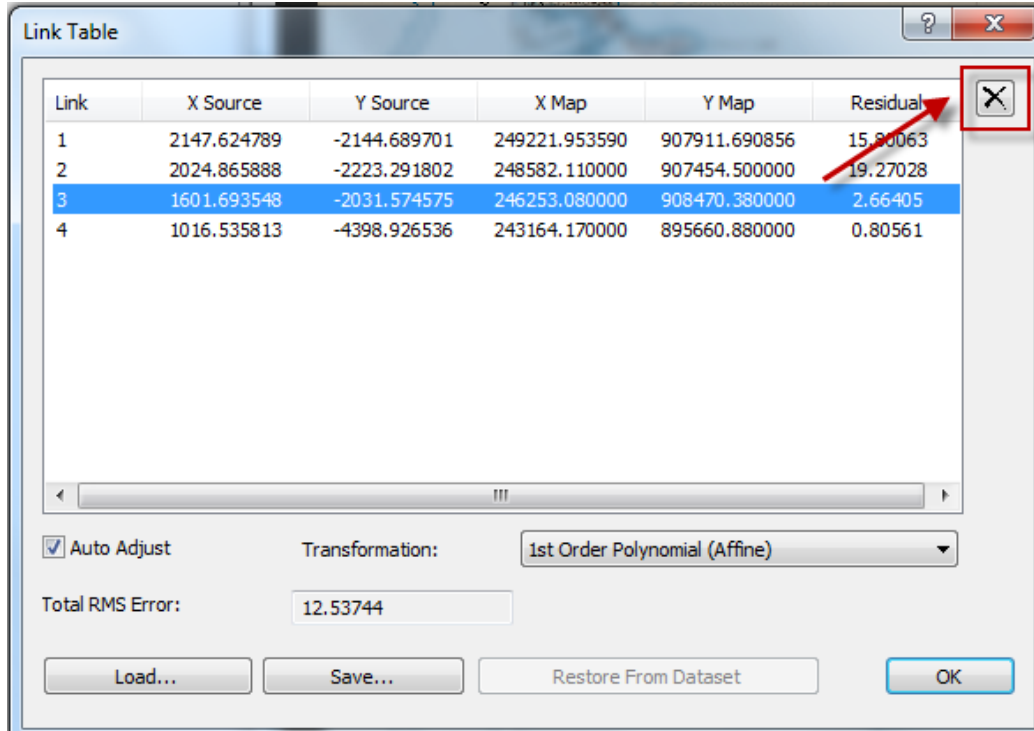




8. Zoom in to the area of a map location (such as a street intersection or, in the case of the tutorial, a spit of land) which you can easily distinguish in both the image and in one of the already geo-referenced shapefile themes. These will be the control points, or shared points between your image and your existing geographic data.
9. Click on the **Add Control Point** tool 
10. Click on the first 'common point' on the digital image you want to georeference, then click on the same point in the existing geographic layer. Do the same with as many other 'common points' you can find until you like the result. You need at least 4 points. This procedure is also called "rubber-sheeting". Remember, you always **click on the un-georeferenced image first**, then on your geographic data layer.



11. You can use the zoom and pan tools during this process to zoom in to see your points more clearly – this will also help to make your control points more accurate, rather than trying to create them with the entire area in view. **Note:** If you accidentally click the layers in the wrong order or make a bad control point, **do not hit “Undo”** or you may lose the last layer added and all of your control points. Instead, open the **View Link Table** , click on the point, and press the  in the upper right hand corner, or the delete key, to remove it.



12. You should check your control points occasionally by choosing **View Link Table** icon on the *Georeferencing* toolbar. This will show you all the control points, and when you have more than three it will show you the RMS error. You can delete control points that have large errors and re-enter them or enter other points which result in a lower error.
13. When you have the image aligned with an acceptable (less than 50) **RMS error**, you should record the RMS error for data quality reporting. Now select
14. When you have completed the georeferencing process, you can create a permanently georeferenced image by choosing **Rectify** from the *Georeferencing* menu - you can accept the default cell size that ArcMap calculates or set your own. For scanned maps, you can leave the resampling type set to Nearest Neighbor. Specify a name and location for the new image. The result will be a .tif image
15. With this georeferenced image, you can now digitize new features from the map.