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Visually Geo-Referencing Images

By Bill Bergmann

We have extended the IMAGE GEO-REFERENCE EDITOR to allow visual modification using your mouse. This can be useful to make small adjustments to how an image aligns with other real world entities in a quick, intuitive manner. We accomplished this by wrapping a control border around the image when shown in the map window. If you are familiar with the HYPACK® Plotting Sheet or Matrix Editors, then you will be instantly familiar with its operation. The control border in each of these editors consists of a thick solid line showing the edges of a rectangle along with a mouse interactive control in each corner.

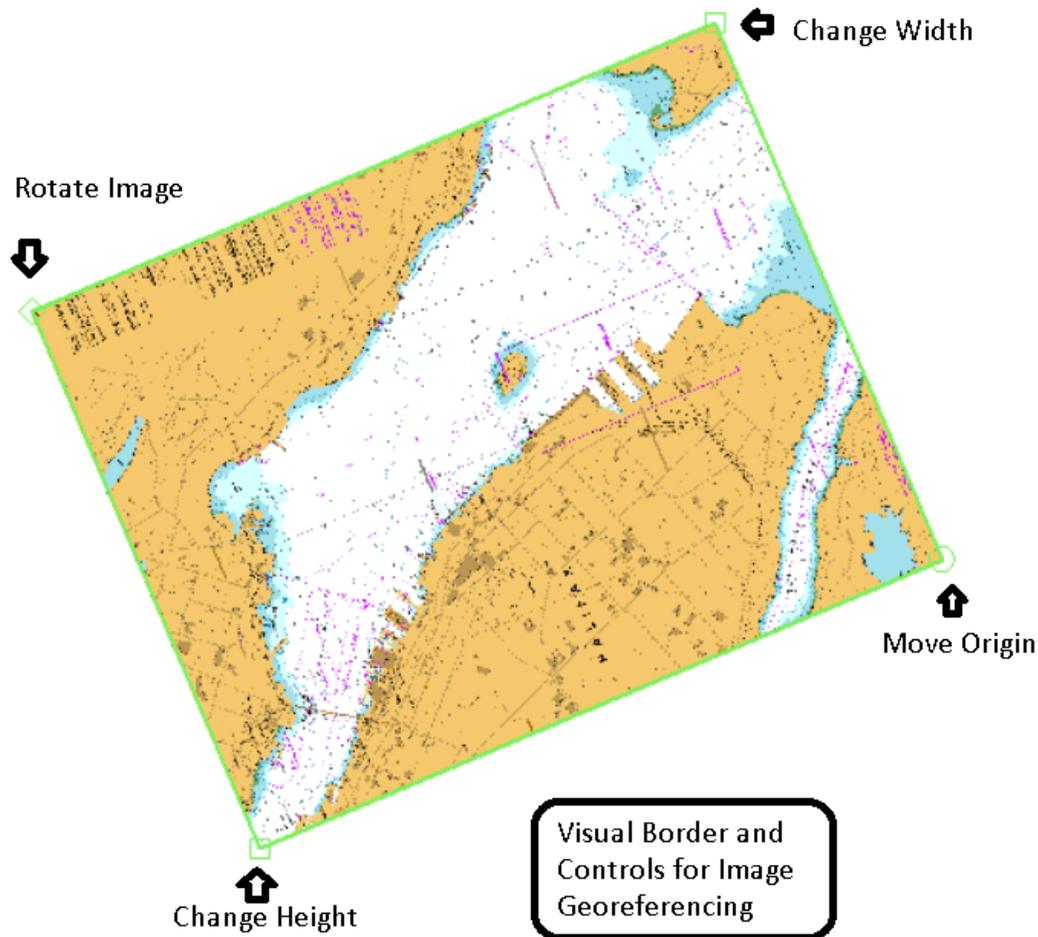
Assuming an un-rotated image, the controls would be laid out in the following fashion:

- **Lower Left corner: Origin Point.** Designated by a circle. Drag to move the image.
- **Upper Right corner: Rotation Tool.** Designated by a diamond. Drag to rotate the image
- **Upper Left corner: Height sizing Tool.** Designated by a square. Drag to change the image height.
- **Lower Right corner: Width sizing Tool.** Designated by a square. Drag to change the image width.

Tip: Regardless of image rotation, the Origin tool is the only circle, and the rotate tool is always diagonally opposite the origin.

The following figure shows the hal_chart.tif image, found in the Sample Halifax project after a 247 degree rotation.

FIGURE 1. IMAGE GEO-REFERENCE EDITOR Tools



The layout of the IMAGE GEO-REFERENCE EDITOR has been adjusted to accommodate this new functionality. We have added a section that decodes the transformation matrix into much friendlier terms, namely origin, rotation and size. You may adjust the values as desired and the editor updates the transformation values when you leave the modified field. You may also adjust the transform fields directly and, again, the editor synchronizes the corresponding decoded fields.

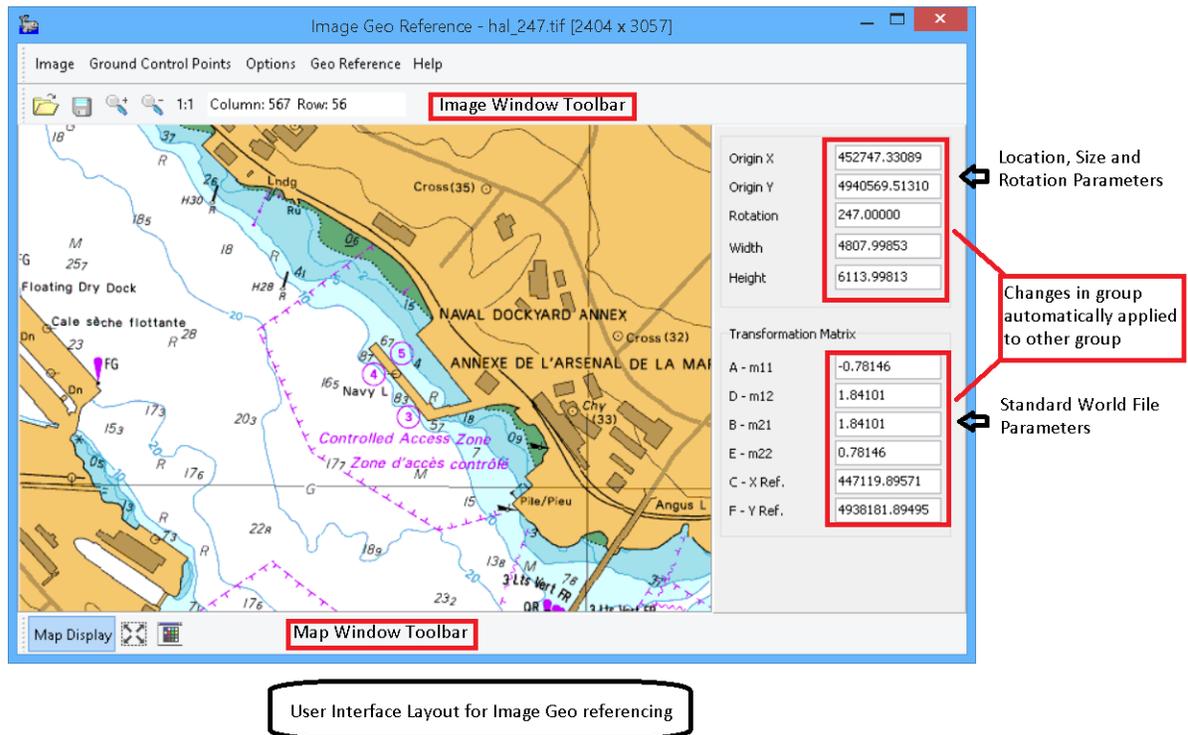
The IMAGE GEOREFERENCE EDITOR is basically manipulating your image in 2 mathematical spaces. The first, which I call raster space, is simply the pixels which make up the source image. In this space, you may pan and zoom and add ground control points. The control points provide information to tie a particular pixel to a location in the second space known as world space.

The editor provides 2 functions to build the transformation matrix using control points:

- A **2 Pt transformation** generates a referencing matrix such that the given control points are honored in world space.
- The **3 Pt+ method** warps the image pixels as required and generates a new, un-rotated image. A reverse projection is used in this method to eliminate the need for despeckling.

The following figure shows the new IMAGE GEO REFERENCE EDITOR user interface. The top tool bar controls image space manipulation (in the editor) whilst the bottom tool bar relates to world space (HYPACK® Map window).

FIGURE 2. IMAGE GEO-REFERENCE EDITOR Interface



We have added an Options menu group with 2 new choices:

- **Maintain Aspect Ratio** applies when using either the Height Sizing or Width Sizing tools of the new border. When either Height or Width is changed, the related value is modified such that the initial ratio between the two is maintained.
- **Shift Map Origin to Map Window Center** is handy when loading an un-geo-referenced image and you wish to manipulate it visually in your current map window view. One could, of course, also type the position in the Origin X and Origin Y fields or even the X Ref. and Y Ref. fields to achieve the same effect.