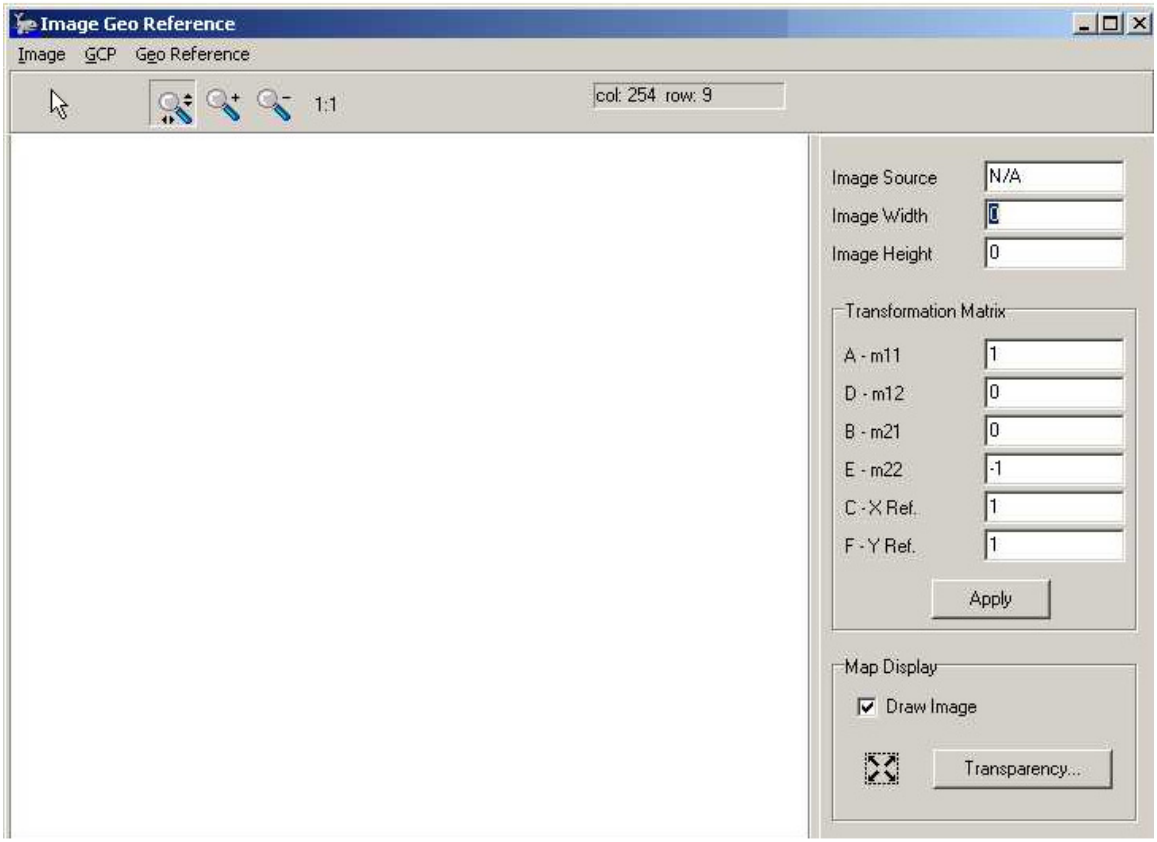
Geo-Referencing Images

by Bill Bergmann

HYPACK 2009 has added the capability to geo-reference raster images.

Georeferencing is the process of assigning information to an image such that HYPACK can display it relative to other data in the world. This information may include 1 or more operations of scaling, rotating, translating and de-skewing the source image data. Under the HYPACK Editors menu you will find the entry 'Image Geo Reference' which will launch the Image GeoReference dialog.



COORDINATE SYSTEMS

Every raster image is composed of colored pixels arranged in rows and columns. Without further information, each image will be assigned a world coordinate of 0,0 in the upper left corner of the picture. The scale defaults to the DPI (Device Pixels per Inch) of your display device, and there will be no rotation in effect. It is very unlikely, given such defaults, that the picture will be displayed correctly in the world, so we must provide referencing information to make the data useful.

TRANSFORMATIONS

The referencing information required is actually an equation to perform a coordinate transformation between the source image and the HYPACK® display. We use the ubiquitous ‘World File’ format to store this data as it is widely supported in the industry. A World File is composed of 6 lines of data which contain the coefficients of a 3x3 transformation matrix. This structure is enough to encode the scaling, rotation and translation factors required by HYPACK®, or other capable software, to correctly display the image in the world.

GROUND CONTROL POINTS

A ground control point, or GCP, contains two coordinate pairs, one in the raster system and a corresponding one in the world system. This important link is what allows us to create the parameters for the transformation equation.

TRANSFORMATION OPTIONS

A number of different techniques are available to reference your image:

- The simplest is to provide 2 GCP’s and select the 2 PT Transformation option. HYPACK® will calculate the transformation parameters for you. The results are displayed in the Transformation Matrix section of the Image Geo Reference dialog.
- You can also manually enter these values, or modify them, then click [Apply] to see their effect on the resulting image.
- A third technique requires a minimum of 3 GCP’s but will use more if provided. The option 3+ PT Rectification is used to generate a new image from the source image using a best fit equation developed by the editor using the given GCP’s.

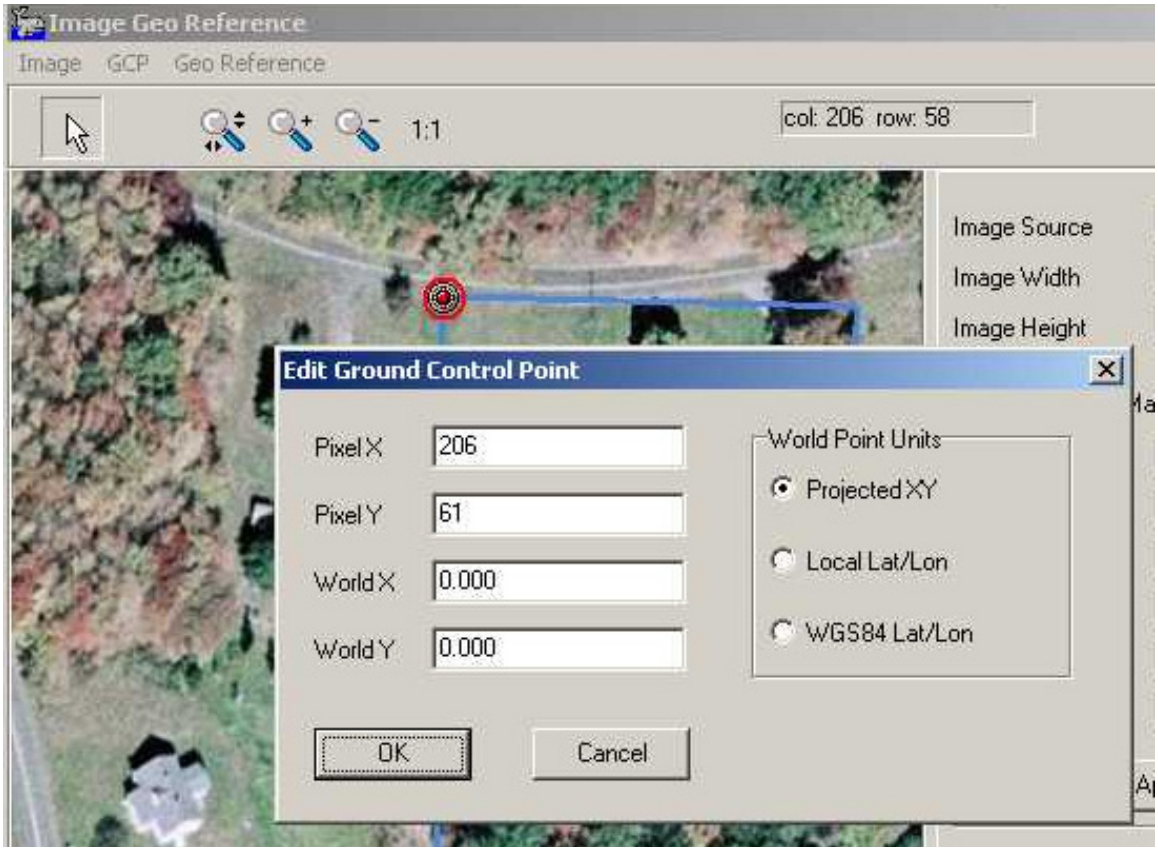
USING THE EDITOR

1. **Load your image**. Supported formats are TIF, JPG and BMP formats. The image will be displayed in the editor dialog.

   Tools for panning and zooming are provided. The 1:1 button will zoom the picture so that the upper left corner of the display contains pixel 0,0 and the scale is set to display at native resolution.
2. **Enter your Ground Control Points** in the GCP Editor.
   a. Select the Arrow cursor to go into GCP edit mode.
   b. Insert a GCP by double-clicking a feature in the image. The GCP Editor automatically opens with the Pixel X and Pixel Y fields filled with the coordinates of the clicked position.
   c. Enter the corresponding world coordinates. You have the choice of entering in XY or Latitude, Longitude coordinates.

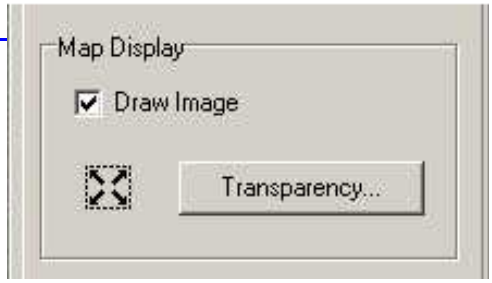
Note: You can also open an existing GCP (from a previous session) in the GCP Editor. Just move the cursor over it to highlight it in red, then drag or double-click it to open it in the GCP Editor.

FIGURE 1. *Entering Ground Control Points*



3. **Select a method for Geo-Referencing**: Manual, 2 PT Transformation or 3+ PT Rectification.
4. **Preview your work.** As work progresses, the converted chart will update and display in the HYPACK® map window. In the bottom right part of the editor, you will find options for viewing the referenced image.

FIGURE 2. *Viewing the converted chart*



The **Draw Image** check box allows a single-click refresh of the map window with the chart visible or not.

The **4 arrows button** will zoom the map window to the extents of the image.

Finally, you can set a **transparency** to blend the image with the HYPACK® map window as an aid to verifying the quality of your GCP's and the HYPACK® calculation of the Transformation Matrix.

5. **Save your work**. The editor outputs either TIF + TFW files or a single Geo-referenced TIF file. A disk space saving option is also provided, where you can save the TIF using LZW compression.