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NATURAL ENVIRONMENT RESEARCH COUNCIL

ERDAS Imagine 8.5 and 8.6 Training Manual

Geoscience Resources & Facilities Directorate

Internal Report IR/04/030

BRITISH GEOLOGICAL SURVEY

INTERNAL REPORT IR/04/030

ERDAS Imagine 8.5 and 8.6 Training Manual

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Foreword

This report is the published product of a study by the British Geological Survey (BGS).

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Summary

This report describes a number of training modules for ERDAS Imagine, covering basic image processing techniques.

Introduction

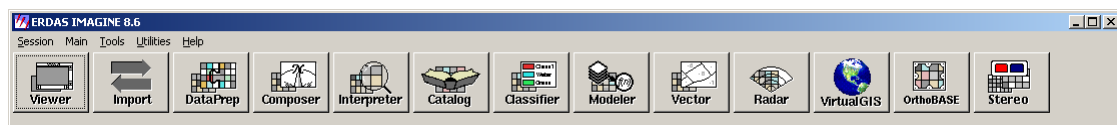
ERDAS Imagine is a frequently used software package within the Remote Sensing Section. Over a number of years experience has been gained in applying its functionality to a variety of projects both in the UK and overseas. The aim of this report is to present a collection of modules for knowledge transfer and training purposes.

The collection of data, which is referred to within this report, is available from the Remote Sensing Section.

1 Module 1 - Basics

Main Menu

When ERDAS IMAGINE is opened the main interface starts automatically (see below). This menu bar, which can be positioned at any convenient place on the screen, contains, through a series of drop-down menus, all the commands and processing features used in IMAGINE.



From left to right the buttons are:

- **Viewer:** clicking on this with the left mouse button opens the viewer, this is the window in which imagery is displayed and simple processing takes place.
- **Import:** contains procedures for importing data into the native format of IMAGINE (.img). Also contains procedures for exporting data to other commonly used geo-data formats such as GeoTiff, DGN, GRID, Shapefile.
- **Data Prep:** used to access fairly common routines, such as creating a new image, subsetting (cutting out) an image, and reprojection of the data.
- **Composer:** is used for the production of maps from georeferenced data.
- **Interpreter:** contains many more advanced data processing options, these may concern processing the imagery to enhance the spectral or spatial information, or even some more basic options such as stacking a series of image layers into one image.
- **Catalog:** is used to organise your data and find out simple information about it.
- **Classifier:** used to classify image pixels based on their values in different spectral bands.
- **Modeler:** allows the user to produce graphical models for specialist routines, which may not be available from the normal menus.
- **Vector:** contains menus for the vector utilities, such as cleaning and building vector data, conversion to raster etc.
- **Radar:** menu for the radar utilities.
- **VirtualGIS:** starts the VGIS viewer – the main interface for 3D display of data, also allows the user to produce movies.
- **OrthoBASE:** tools to set up the parameters required to view an image stereo pair
- **Stereo:** tools for the viewing of stereo imagery, also allows for feature digitisation in 3D.

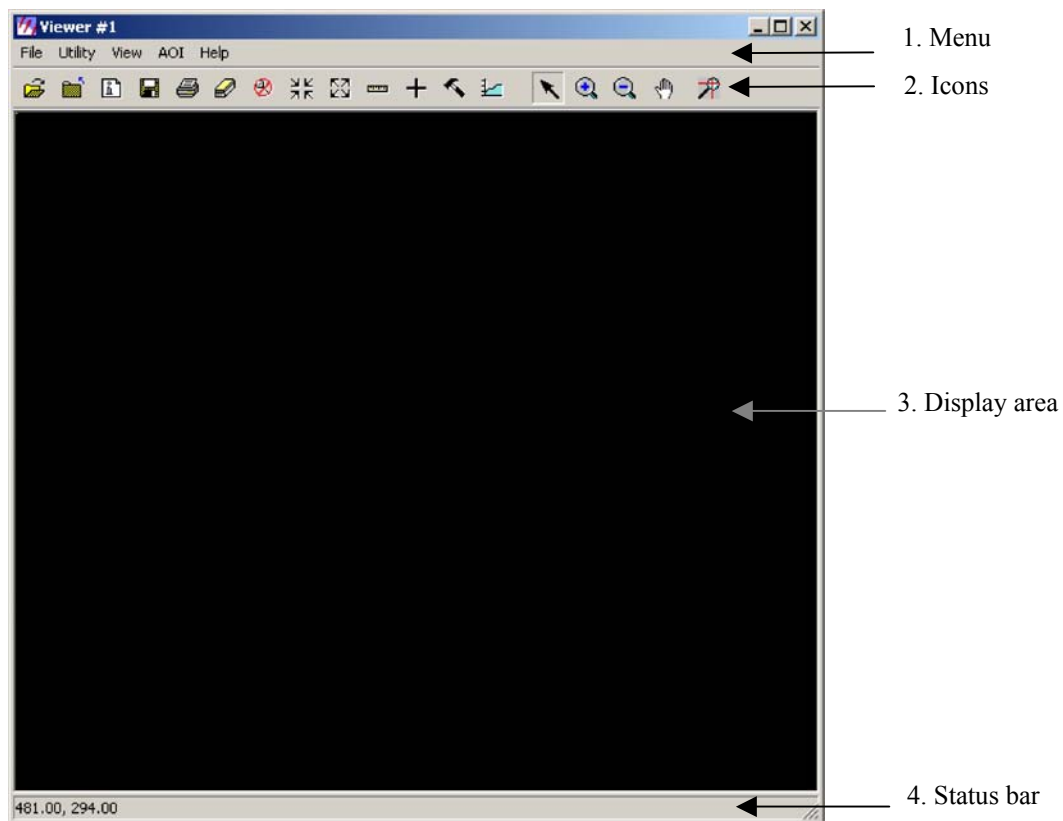
The Viewer.

The viewer in IMAGINE is the tool used to visualise both raster and vector data in 2D, and is opened by left clicking the **Viewer** icon on the main tool bar. There are two types of viewer available in Imagine 8.6, the 'Classic Viewer' and Geospatial Light Table (GLT).

Any number of Classic Viewers can be open at the same time; therefore each is automatically numbered and the filename is displayed in the title bar to help with organisation. The data in the viewers can be geolinked so that, for example, panning in one window will automatically cause the others windows to pan to the same location.

There are four sections to the Classic Viewer.

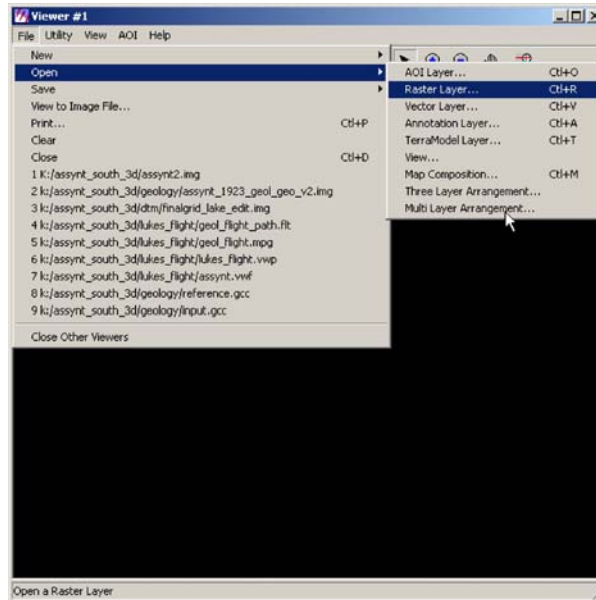
1. **Menu:** gives access to applications.
2. **Icons:** One-click access to commonly used applications.
3. **Display area:** the area where data are visualised.
4. **Status Bar:** gives the co-ordinates of the cursor position and information on the function of an icon.



The GLT is a Classic Viewer with a few handy add-ons. Multiple classic viewers can be opened in a GLT, and there are tools and icons to simplify many common processes. Also, the GLT is similar to a MapInfo Workspace *i.e.* the session can be saved to enable quick return to the same screen layout.

Opening Image Data.

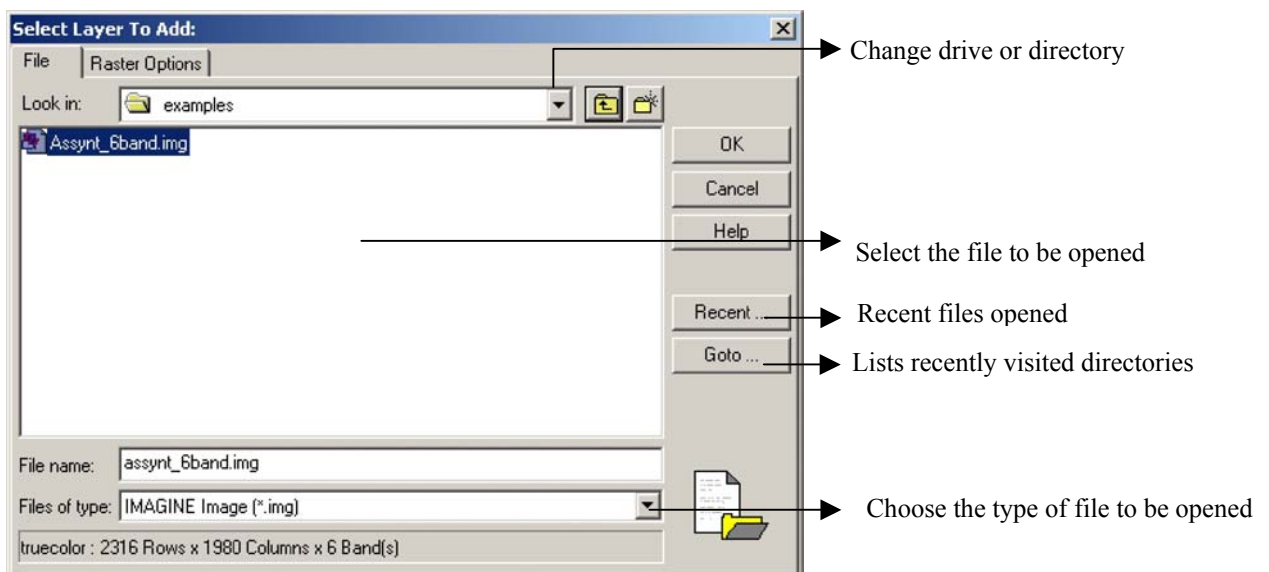
In the Viewer menu, select **file| Open**, then **Raster Layer**.



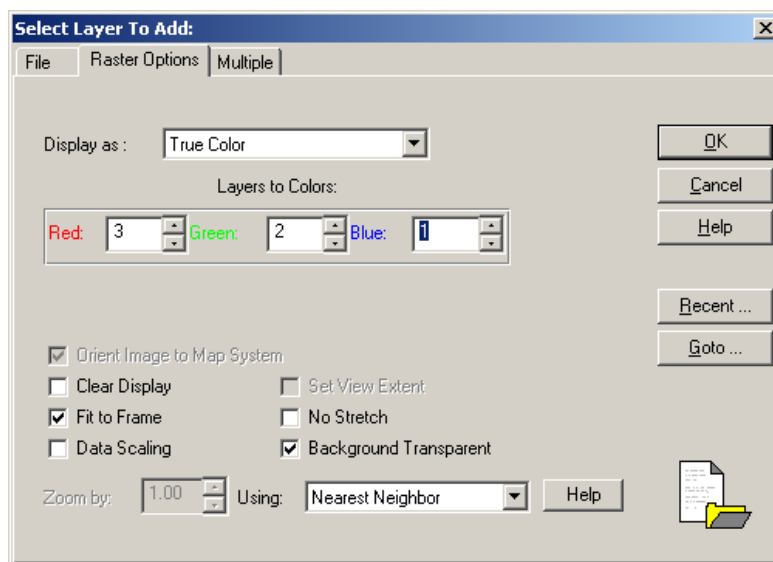
The **Select Layer to Add** dialog opens (see above), this is the standard dialog for opening files in IMAGINE. It allows the user to navigate to the file of interest and open it, much the same as in any windows based application.



To open a file quickly, the **Open Layer** icon from the Viewer Icon panel can be used. Files can also be dragged into the Viewer from Windows Explorer but fewer options are available this way.



Navigate to the **E Drive** on your machine, go to the **ERDAS_Training** folder and select the **Examples** folder. Ensure that the **Files of Type** is set to **IMAGINE Image (*.img)**, find the file **Assynt_6band.img** and single click on it to highlight. The name will appear in the file name box in the **Select Layer to Add** dialogue. Now click on the **Raster Options** tab at the top of the **Select Layer to Add** dialogue. Ensure that the **Display as** is set to **True Color**, alter the **Layers to Colors** so that Layer 3 is set to display in Red, layer 2 in Green and Layer 1 in Blue. Also ensure that the other settings are as shown below.



Now click **OK**. You will now have the image loaded into the viewer. The image should be a true colour composite; that is the colours displayed will be similar to those in real life.

What does the 'Layers to Colors' option mean?

The Landsat 7 sensor acquired the image you have just displayed, this records light reflected from the earth's surface. The satellite has multiple sensors onboard; each records reflectance in a distinct region of the electromagnetic spectrum, these regions are known as bands. Landsat 7 data records 9 bands, these bands handled as 'layers' in IMAGINE.


So, when you opened the image you put band 3, which corresponds to light reflected in the red region of the EM spectrum in the Red colour display. You also put Band 2, which records the reflected green light in the Green display, and Band 1, corresponding to the reflected blue light in the Blue display. Since the bands are displayed in the same colour as the region of the EM spectrum that they relate to, colours in the resultant image will match those that you are used to seeing in a normal colour photo.

It is possible to create false and pseudo colour composites by displaying bands in different colours, but we will come onto that later.

Zooming and Roaming.

Note that the GLT contains more functions than the Classic Viewer.

Maximise the Classic Viewer, right click anywhere within the display area, a Quick View menu will pop up. Move down and select the **Fit Image to Window** option. This is also possible using an icon

shortcut in the GLT .

1.1 WE WILL NOW LOOK AT THE FUNCTIONS AVAILABLE IN THE VIEWER.


- **ZOOMING AND ROAMING CAN BE DONE TWO WAYS:**

- Go to **View | Zoom | In by 2** on the viewer menu, this will zoom in by 2 times. Open the **Quick View** menu and select the **Fit Image to Window** option to get back to the original size.

- An easier way to zoom in is to use the  icon, left click, hold and drag to define an area to zoom into.


- You can now use the  to roam about the image.

- Find the viewing scale:

- In the Viewer Menu go to **View | Scale | Scale Tool**, a dialog will pop up indicating the scale you are currently looking at. Use the dialog to zoom to 100 000 scale (tip: leave out the space). Now select the  icon, position it in the centre of the viewer and left click once – what is the viewing scale now? Repeat this last step again – what is the viewing scale and what does the image look like? Can you think why this maybe?

- In the GLT the scale view is constantly visible in the Zoom/rotate portion of the window.

- Image rotation in GLT:

- Using , click the middle mouse button to interactively rotate the image.

- Rotation and alignment can also be altered by clicking the right mouse button in the bottom right hand corner of the GLT and choosing between grid north, true north, or file north.

- In-view magnification using the  icon in GLT turns the cursor into a magnifying glass.

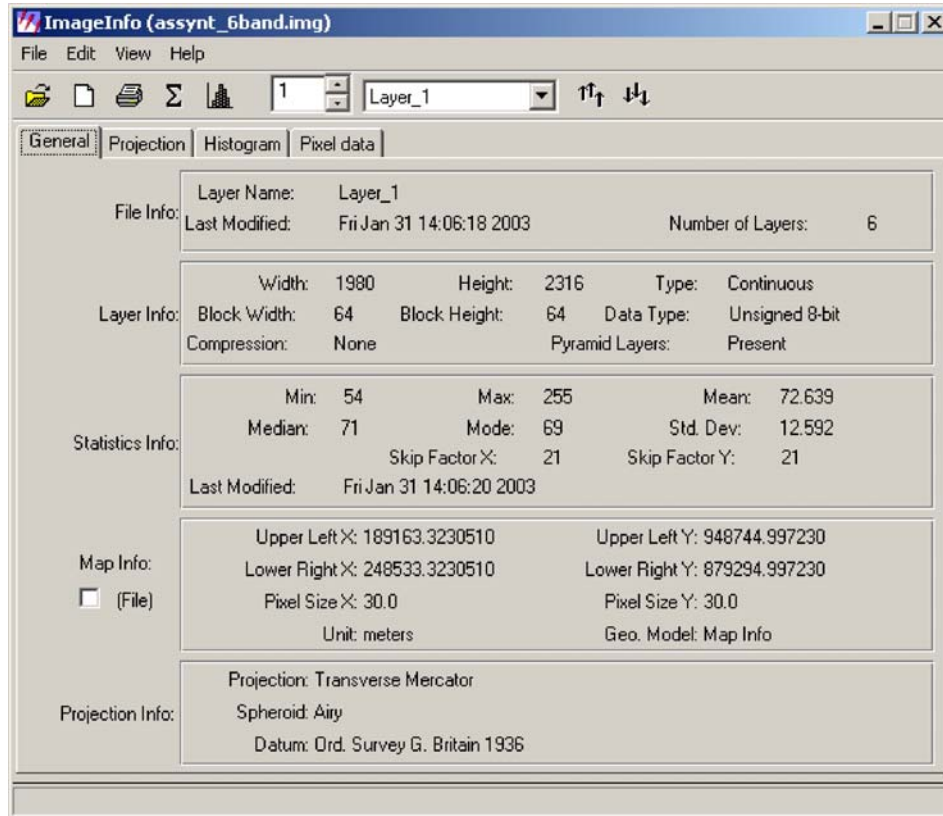
1.1.1.1 DERIVING INFORMATION ABOUT THE IMAGE

Image Information.

- From the viewer menu go to **Utility | Layer info**, this can also be accessed by clicking the

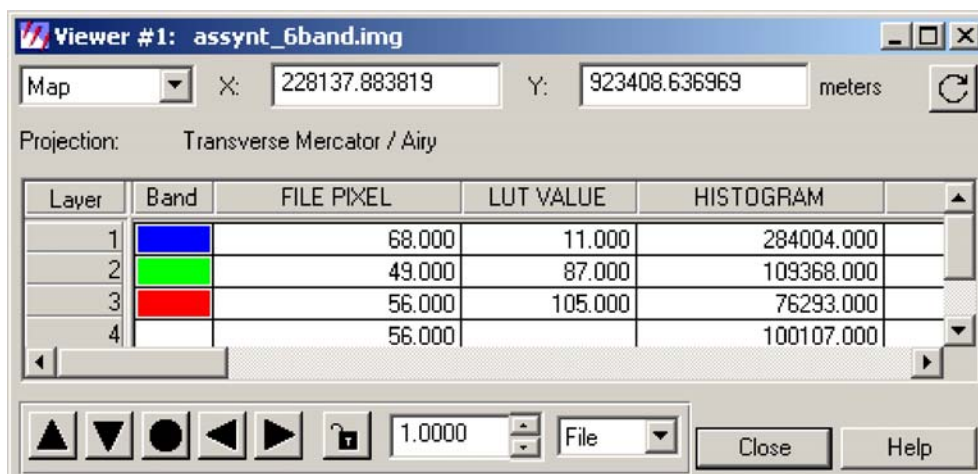


icon. This will open a dialog:



This dialog is useful for adding projection information to an image. This is something that we will address later.

- From the viewer menu select **Utility | Inquire Cursor** a red cursor will appear on the image and a dialog will open. The cursor can be moved around and the values in the dialog will alter.



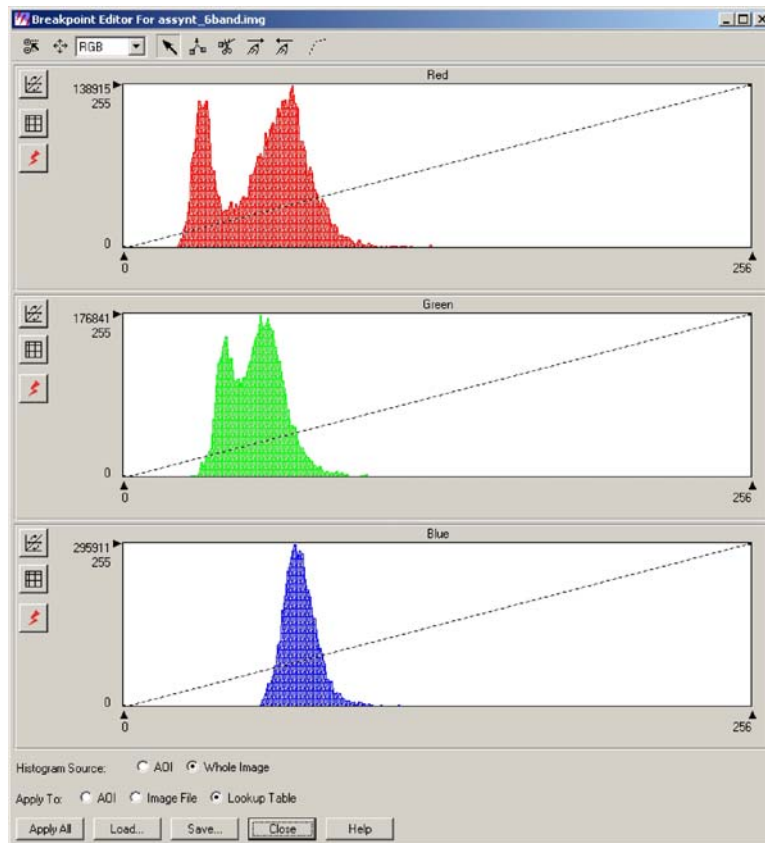
The file pixel column gives information about the pixel values of the image. Pixel values are related to the surface reflectance in that band. The LUT value column shows the value for that pixel after it has been contrast stretched.

Altering the appearance of the image:

Contrast Stretching:

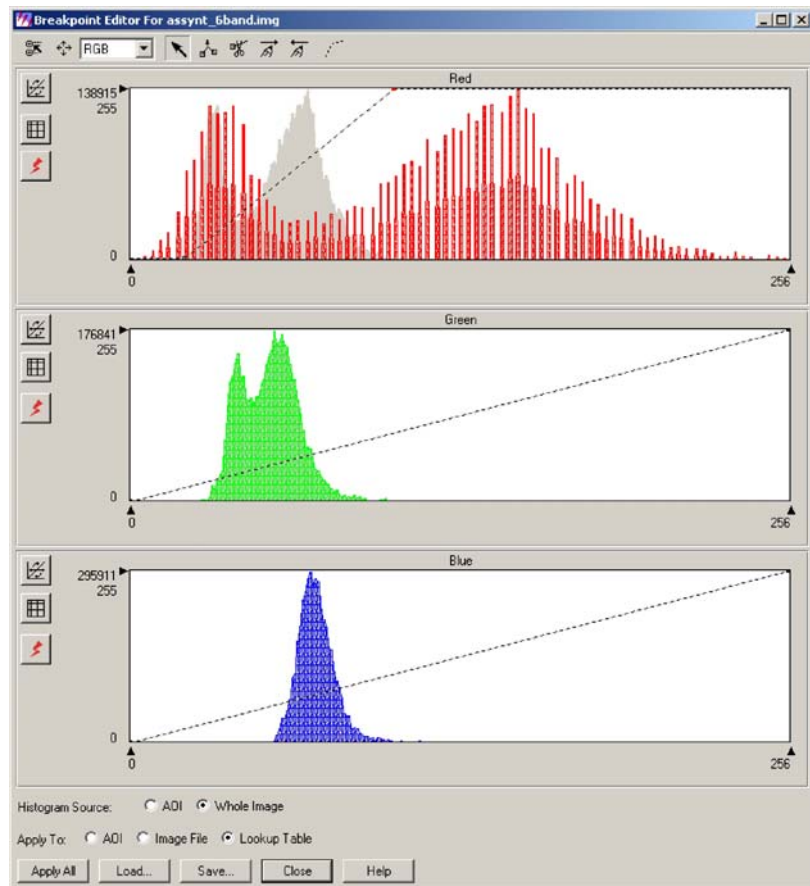
Multispectral satellite imagery is commonly recorded in an 8bit format (although RADAR is generally 16-bit); a pixel could therefore have a value anywhere between 0 and 255 ($8^2 = 256$). However it is very rare that information recorded from an area will utilise this full range, which leads to images looking either overly dark or bright when displayed. To resolve this the pixel values of a band need to be 'stretched' so they occupy the full 0-255 range, the process for doing this is called contrast stretching.

- From the viewer menu choose **File | Clear** to clear the viewer.
- Open the same image in the same way as before ensuring that bands 3, 2 and 1 are loaded into red, green and blue, however this time, in the Raster Options check the **No Stretch box**. The image will open but this time it will be very dark – it needs contrast stretching!!
- From the viewer menu select **Raster | Contrast | Standard Deviation Stretch**. IMAGINE will apply a stretch based on the statistics of the data.
- The result looks a little too bright; this is because of atmospheric haze affecting the Blue band. To remove this we need to stretch the data interactively.
- Close the image and re-open as before.
- From the viewer menu choose **Raster | Contrast | Breakpoints** a dialog will open.



The breakpoint editor shows three histograms of the image data, one for each of the bands/monitor colour guns. These are essentially frequency plots, indicating the pixel distribution throughout the 8-bit range. The plots indicate the pixel value distribution of the original image. At present the data have not been stretched, therefore the plots do not occupy the entire range of possible pixel values. We want to stretch the histograms so that the minimum and maximum values are at the ends of the 8-bit range (i.e. so the coloured histograms fill the entire 0 – 255 range).

- In the breakpoint editor, ensure that the arrow pointer is selected.
- Move the cursor to the 0,0 position in the red histogram, the cursor will change to a cross indicating that the cursor is over a breakpoint. Click and drag the breakpoint along the x-axis to the start of the red histogram, release when there.
- Now move the cursor to the top right corner of the red histogram, where the line intersects the edge of the box.
- Click and drag this breakpoint, along the top of the x-axis, to the end of the red distribution, then release. Your breakpoint editor should now look as shown below:

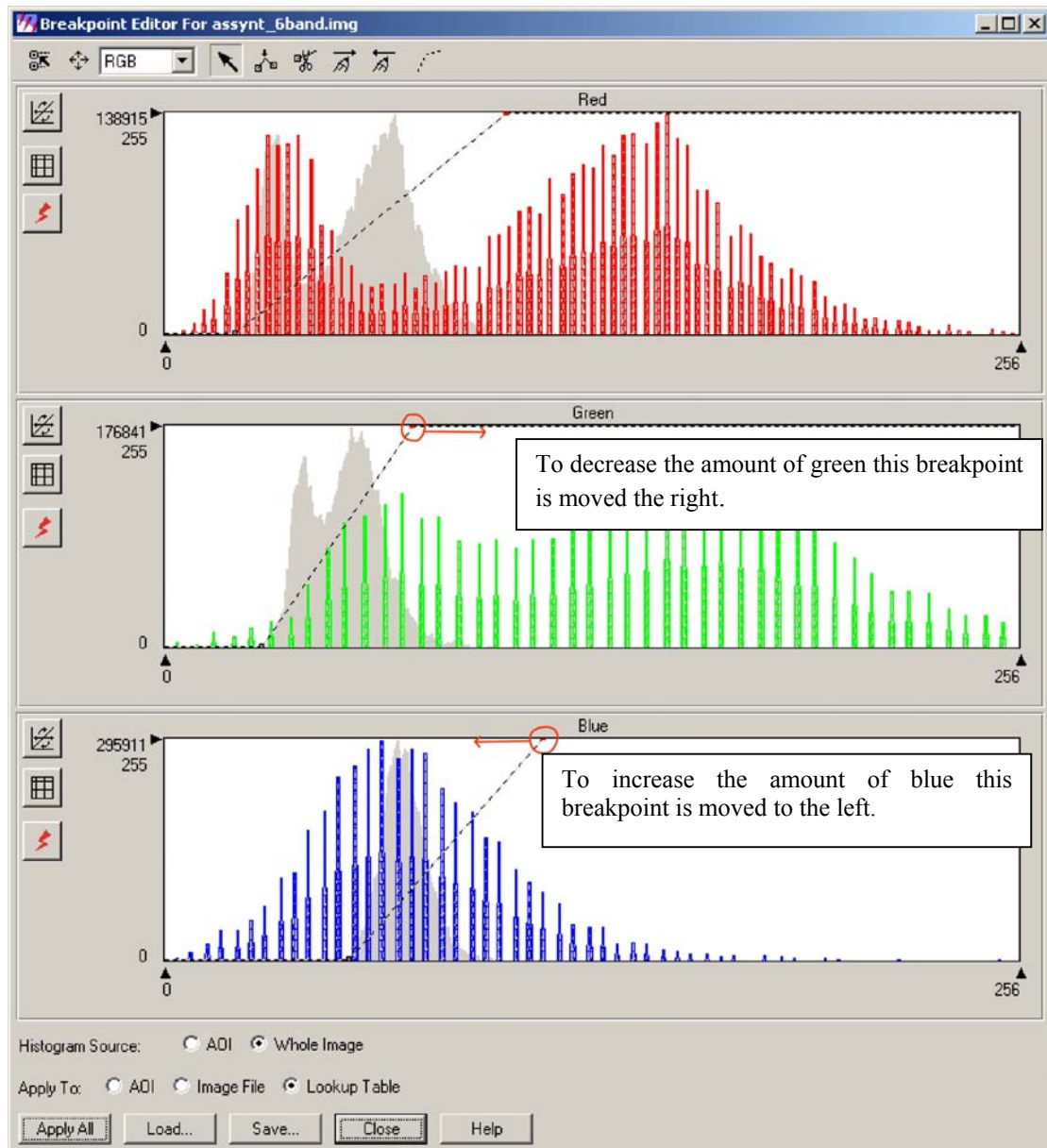



The grey histogram is the original data distribution, while the red histogram shows that the effect of the stretch is to distribute the data evenly throughout the 8-bit range.

- Now repeat the prior steps for the green and blue bands.
- Ensure that **Whole Image** is checked for the **Histogram Source** and **Lookup table** is checked for the **Apply To**, then click **apply all**, the image should now look more pleasing to the eye.

*A **Lookup Table** is a table containing the input and output values for your stretch; the system then refers to this table to display the image in the correct way. A Lookup Table has the advantage of not altering the actual pixel values, therefore the original data is maintained. If the **Apply To Image File** option is selected then the pixels will adopt a new value based on the stretch.*

- If the image appears to have ‘too much’ of one colour then it is possible to move the upper breakpoint back a little; this will have the effect of decreasing the amount of this colour in the image.
- Similarly if too little of a colour is present then the upper breakpoint for that colour can be moved forward (to the left), this will increase the amount of that colour in the image.

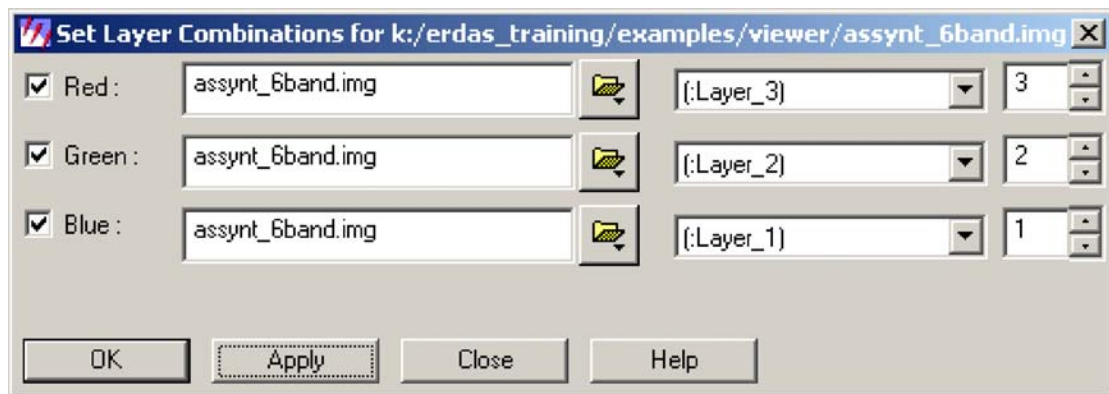


- NOW EXPERIMENT WITH THE INSERT BREAKPOINTS BUTTON , AND ADD BREAKPOINTS TO THE MIDDLE OF THE LINE IN THE EDITOR.
- What is the effect of moving these new breakpoints? You can use these to stretch bimodal distributions such as in the red histogram above.
- When you have reached a stretch that you like, save the breakpoints: In the **Breakpoint Editor** click on **Save** at the bottom of the dialog. A new dialog will appear in which you choose the destination and file name for the saved breakpoints. Give the breakpoints the file name: **Assynt_321_bps** and save it to the same directory that the image is in.
- Whenever this image is opened using the stretch option this will be the stretch that will be applied.

Displaying different Bands

As already mentioned satellite imagery often has more than three bands, however the computer monitor only has three colour guns/channels (red, green and blue). Therefore a maximum of 3 bands can be displayed at once. Until now we have been working with a true-colour composite, bands 321 displayed in red, green and blue. However it is often useful to display other bands, since these provide information from different regions of the EM spectrum. For example bare rock and soil reflect strongly in the mid-infrared region – a region corresponding to Landsat’s band 7, while green vegetation reflects strongly in the region corresponding to Landsat’s band 4. We may therefore want to include these bands when displaying the data. One way of doing this is to use the Raster Options when opening the image, however this is not very convenient if you want to change the bands frequently.

- Keep the same image in the viewer; you should already have Bands 3, 2 and 1 displayed to give a true-colour image.
- From the viewer menu select **Raster | Bands Combinations**, a dialog will appear:



- The middle three boxes allow you to set which layer/band is displayed in which colour gun of the monitor. This can also be done using the boxes on the right.
- What happens if all three layers are set to be the same? Why do you think this is?
- Set the bands to be Red = Layer 6, Green = Layer 4, Blue = Layer 1. This is called a 7,4,1 band combination. (In this case layer 6 in the image is band 7 from the satellite, this is because band 6 from Landsat is the thermal band and has a different spatial resolution to the others and so was not included when we produced the image).
- You will notice that the image will be dark once again, this is because you only stretched the first three bands. Open the breakpoint editor and stretch bands 6 and 4. Save these to a file with a relevant name.

Altering the band combination is quicker in the GLT using the Spectral tools on the right side of the window.

Opening a Greyscale Image


Black and White Aerial Photography (and panchromatic satellite imagery) is saved as a single band and is therefore displayed as a greyscale image, the tone of which depends on the value of the pixels.

- With the satellite image of the Assynt area still open in the viewer, select **File | Open | Raster Layer**, navigate to the file called **Assynt_photo_mos.img**, highlight it and then click the **Raster Options** tab.
- Ensure that the **Display as** option is set to **Greyscale** and that the **No Stretch** box is **Unchecked**. Click **OK**.

An aerial photographic mosaic will open on top of the satellite image. This has much finer resolution than the satellite image so take some time to zoom and roam to explore the imagery. Use the **Image Information** utility to find the resolution (pixel size) of the image.


Finding a Co-ordinate on the Image

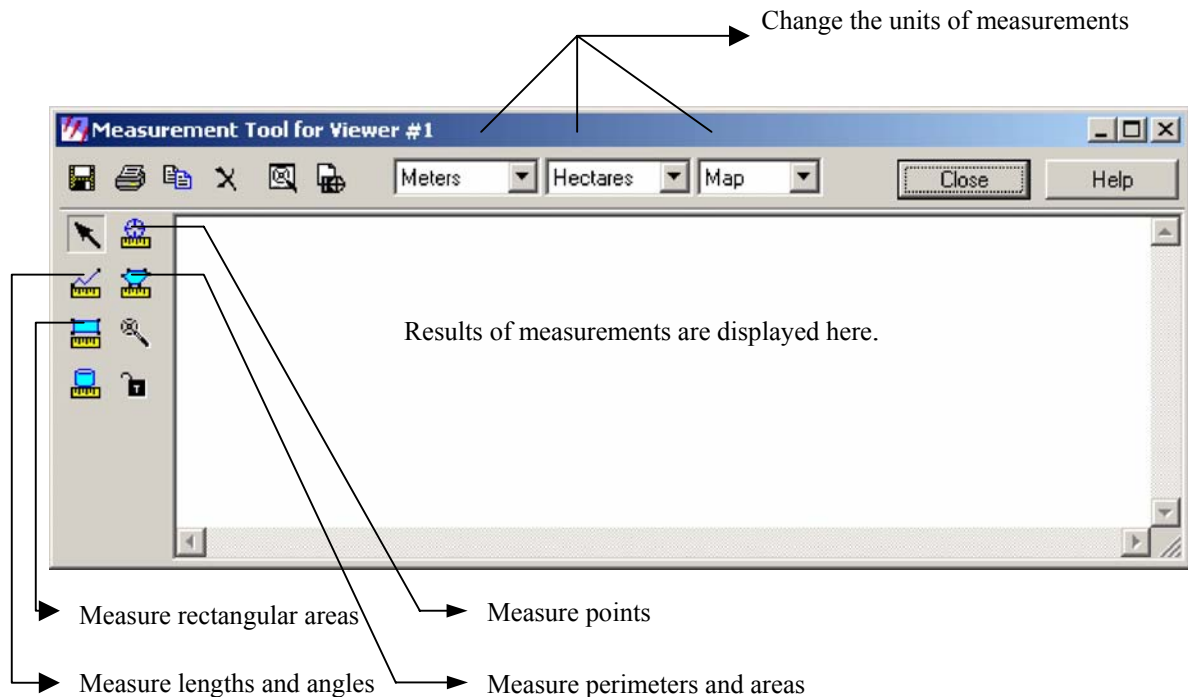
Sometimes it is useful to be able to type in a co-ordinate and have the system take you there.

- Open the **Inquire Cursor** from the **Utility** menu as you did before; alternatively this can be opened using the  icon.
- Alter the numbers in the dialogue box so that **X = 223353** and **Y = 911062**. Press Return when the numbers are entered and the cursor will jump to this position.
- The cursor will now have moved to the edge of a Loch, use the zoom tool to zoom in on this area.

Making Measurements

Since the imagery used in IMAGINE is georeferenced it is possible to make measurements of features. Here we are going to use the measurement tool to find the length, perimeter and area of the loch.

- From the Viewer menu select **Utility | Measure**, alternatively click the  icon.
- A dialog will open, this has a selection of icons that are used to make the measurements and an area in which the measurements will be displayed. The user can change the units of measurements also.



- Select the **Measure Perimeters and Areas** tool digitise a polygon round the shore of the loch. Left click to start the polygon then left click to place vertices, double left click to close the polygon and obtain the measurement.
- Now use the **Measure Lengths and Angles** tool to find the length of the loch.
- Make a note of the measurements and close the toll down, there is no need to save the output.

1.1.1.2 EXAMINING SPATIAL RELATIONSHIPS BETWEEN TWO DATASETS

We still have two datasets open in the same viewer, often it is useful to be able to change which is displayed on top. A method for comparing the two images is also useful, especially for checking georeferenced data.

- From the viewer menu select **View | Arrange Layers**, this will open a new menu window. This window shows what layers you have loaded into the viewer in the order that they are loaded *i.e.* top on the list is displayed upper most in the viewer. Simply clicking and dragging the top layer underneath the second layer and clicking the apply button will change the layer order.
- Spatial relationships can be examined by using options available form the **Utilities** menu:
 - **Utility | Blend** will open a dialog with a sliding bar, moving this bar will blend the top layer into the lower layer.
 - **Utility | Swipe** allows a similar operation, however this time the upper image is ‘rolled’ backwards and forwards or up and down over the lower image – this is a very useful operation.
 - **Utility | Flicker** allows the upper image to be turned on and off.
 - All three of these can be automatic or manual, in practice the manual option usually works the best.

- Use both the satellite image (in whichever band combination you want – you can change these half way through) and the aerial photo, and a combination of the techniques we have covered, to answer the following questions:
 1. What is the projection of the satellite image (Image Information)?
 2. What colour does the snow (at $X = 229242$, $Y = 886392$) on the satellite image appear in a 457 band combination? (Note the image will need stretching after the bands have been changed).

Module 2 – Import/Export

Importing and Exporting – 1. *Introducing the Import/Export menu*

This module assumes knowledge of

- Imagine Viewer

Imagine allows the import and export of both raster and vector files in a number of formats. Some files such as GeoTiff can be displayed without first importing. However, if raster files are going to be manipulated within Imagine, it is usually recommended that these files are imported first. This conversion to '.img' format will allow faster display due to the presence of pyramid layers and expands the number processing options available.

With respect to vector data, IMAGINE will display ArcInfo coverages and ArcView shapefiles without the requirement to import them. However, there are a number of bugs when displaying shapefiles, therefore it can be preferable to import these first. ERDAS uses ArcInfo coverages as its native format, along with 'annotation layers', 'overlay layers' and 'areas of interest' files.

Typical raster files that can be exported/imported are TIFF, GeoTIFF, USGS DEM, JPEG, Generic Binary, DTED...

Typical vector files that can be exported/imported are shapefiles, DXF, ARCGEN.

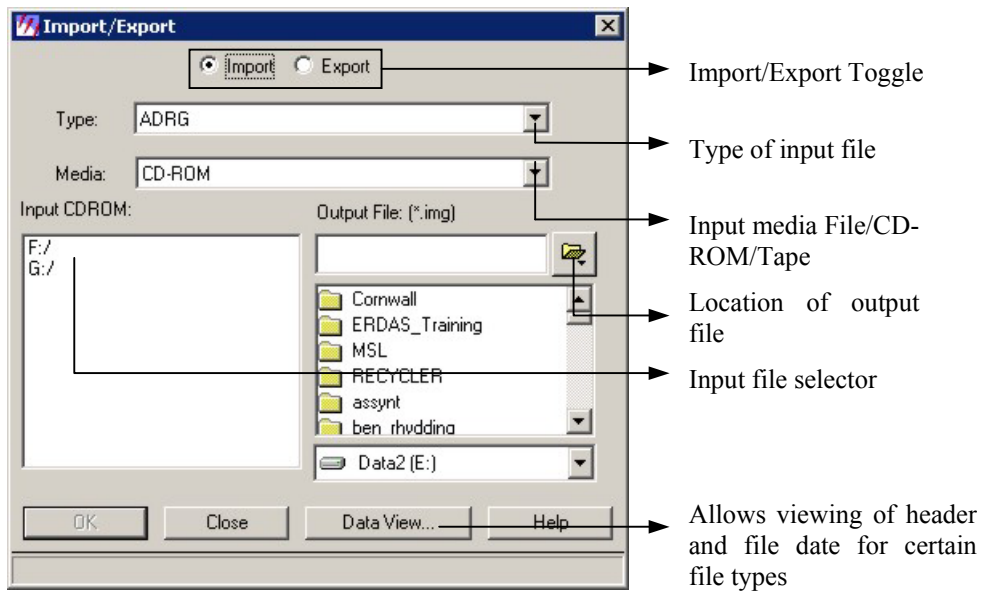
A complete list of files that can be written and read directly and those that can be imported/exported can be found in the appendix.

1. To access the import and export options click the **Import/Export** button on the IMAGINE



Icon Panel (This may take a few seconds to initialise).

2. **The Import/Export** menu will open. The main functions are illustrated below.



We will now work through a number of examples, showing the basic import and export procedures.

This module assumes knowledge of

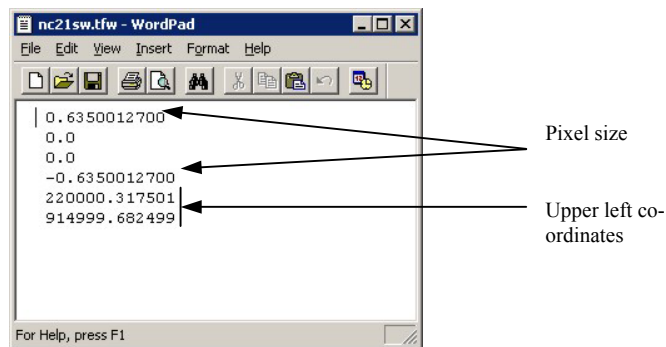
- ImagineViewer

Once an image has been georeferenced or orthorectified, other data can be overlaid to explore spatial relationships between datasets. Overlaying Ordnance Survey 1:10,000 scale raster maps provides useful location information and the merged datasets can be printed out using **Map Composer**.

2. Open *E:\ERDAS_Training\Examples\Import_Export\nc21sw.tif*, in a new **Viewer**.

Ordnance Survey 10K raster maps are available on the corporate network drives. The map we are going to be using has been copied to the Training Examples folder for you.

3. The image is in GeoTiff format and has an associated *.tfw* file that contains some projection information. Navigate to *E:\ERDAS_Training\Examples\Import_Export* using **Windows Explorer** and open *nc21sw.tfw*.



You can see that the file contains information on the pixel size and the upper left co-ordinates. In order to overlay this map onto an image with complete Projection details, IMAGINE needs information on the measurement units and the Projection system.

4. In order to add the missing projection details the image needs to be imported in *.img* format.

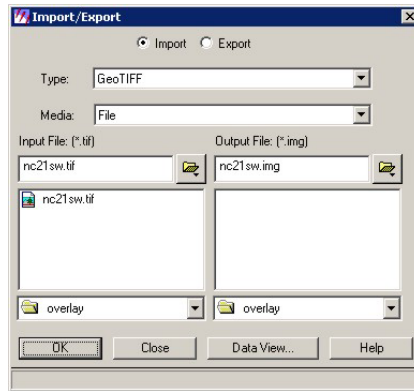


Click the **Import/Export** button on the IMAGINE Icon Panel

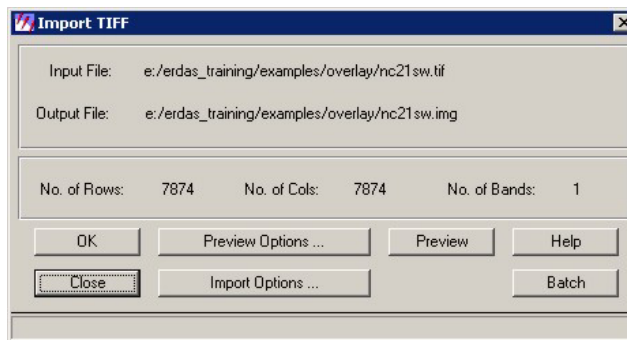
(This may take several seconds to initialise)

5. From the **Import/Export** menu ensure that the **Import** option is toggled and select the file **Type:** as **GeoTIFF**, from the drop down menu. Now change the **Media:** to **File**.

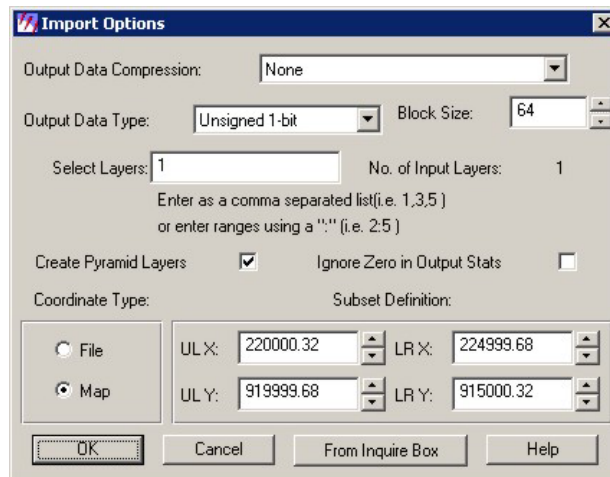
Specify the **Input File** as *nc21sw.tif* (path *E:\ERDAS_Training\Examples\Import_Export*) and the **Output File** as *nc21sw.img* to the same directory. Click **OK**.



6. When the **Import TIFF** menu opens check the input and output images are correct and click **Import Options**.




7. The **Import Options** menu will open. Confirm that the **Create Pyramid Layers** is checked and the **Ignore Zero in Output Stats** is unchecked, and click **OK**.

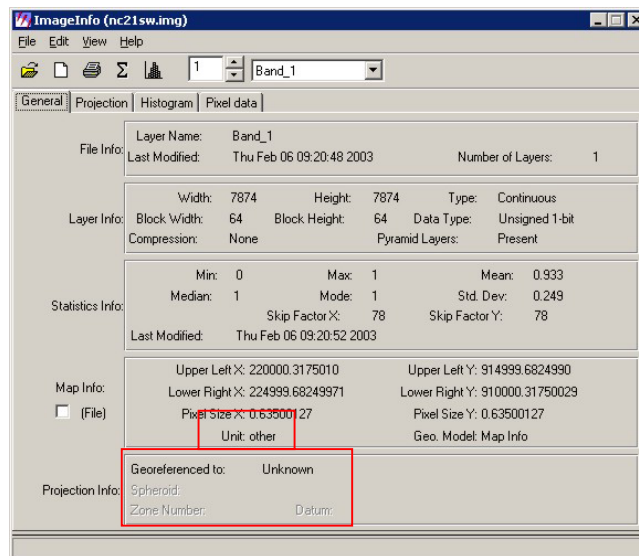


Pyramid layers are reduced resolution images stored within the .img file. Although not essential they allow fast loading, panning and updating of the image within the viewer and give the image a more smoothed appearance. However the image detail will be reduced when viewing at a small scale (zoomed out).

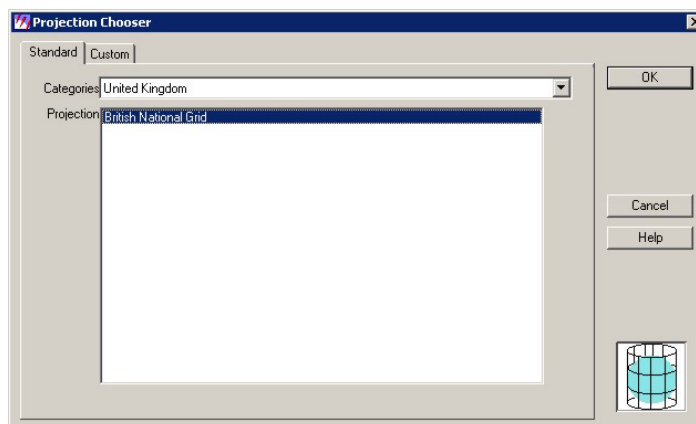
8. You will be returned to the **Import TIFF** menu. Click **OK** to start the import process.

9. Open the imported map in a new viewer. Zoom and Pan around the map. Notice how quickly the image updates, this is due to the pyramid layers, that were created during the import.
10. We now to add the projection information to the image. Go to **View >Layer Info** or to shortcut click . Steps 10-13 can be skipped if using version 8.6.

You will see from the **ImageInfo** dialog box that in the **Map Info** section the pixel size and defining co-ordinates are present but the units are missing and there is no information in the **Projection Info** Section.




10. From the Image Info dialog box click **Edit > Change Map Model**. Specify **Meters** in the **Units** drop down menu and **Transverse Mercator** in the Projection menu. Click **OK** and confirm **Yes**.
11. Go to **Edit > Add/Change Projection**. Click the **Standard** tab and from the **Categories** menu choose United Kingdom and highlight **British National Grid**.



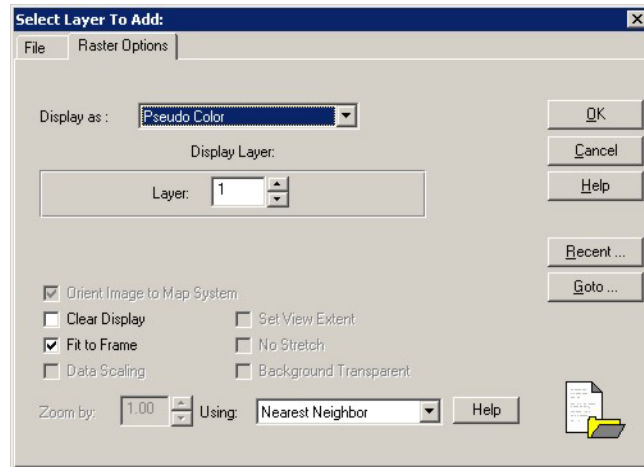
12. Click **OK**. Confirm **Yes** when the attention dialog box appears. The projection information will be added to the image. Close down the **ImageInfo** dialog box.

- In order to update the projection information within the file, we need to close down *nc21sw.img* and reopen.

Remove *st21nw.img* from the viewer using the **Close Top Layer** shortcut 

- To be able to see the underlying image when we overlay the map, we need to make the white areas of the map transparent, while keeping the black areas opaque.

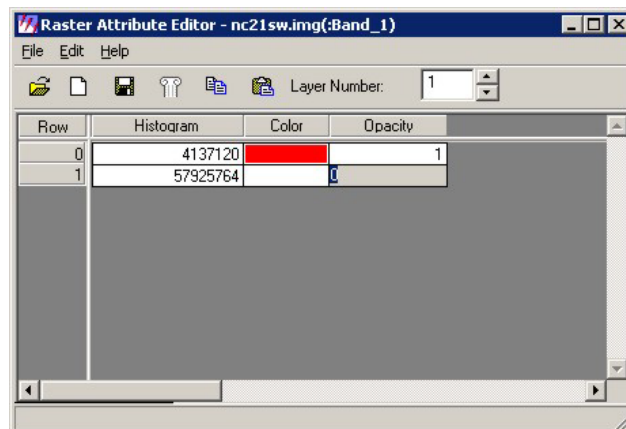
This time we will be opening the image as a pseudo colour layer. Go to **File > Open > Raster layer** and select *st21nw.img*. Before you click **OK**, go to the **Raster Options** tab at the top of the dialog box. From the **Display as:** drop down menu select **Pseudo Colour Layer**.



Images are usually only opened as pseudo colour layers if the data is discrete (e.g. a classified image) rather than continuous (e.g. a satellite image). It allows us to manipulate the colour and the opacity of the image.


Click **OK**

- From the viewer go to **Raster > Attributes**, this will open the **Raster Attribute Editor**

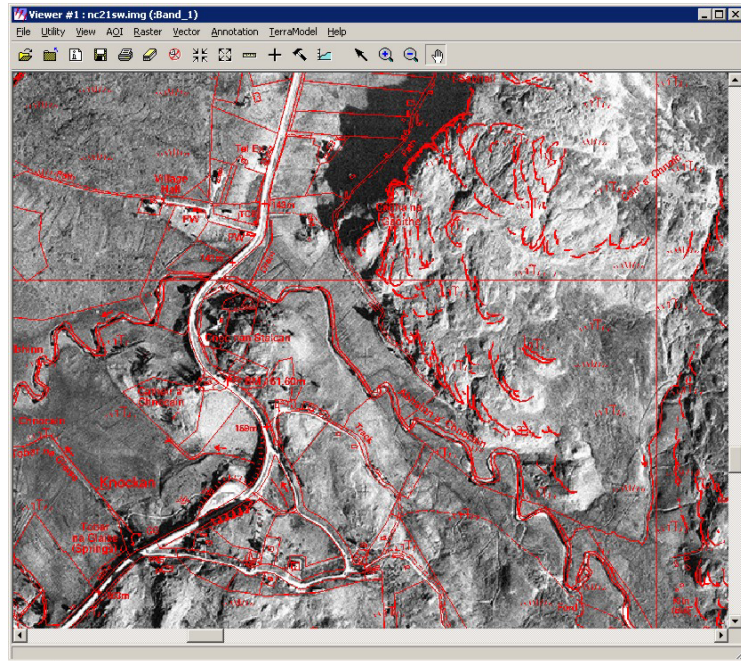


Change the **Opacity** of the white pixels to 0, by clicking and editing the bottom right hand cell of the table. This will make these pixels transparent.

Click on the black filled cell in the **Row 0 Colour** column and change the colour to red.

- Go to **File > Save** to save the changes or shortcut by clicking . Now close the Editor
- In the same viewer as the map open the air photo mosaic (*E:\ERDAS_Training\Examples\Viewer\assynt_photo_mos.img*). Arrange the layers so that the

map is on top. Start the **Inquire Cursor** and type in **X: 223130** and **Y: 912243**. Zoom into 1:6000 scale using the **Scale Tool**, and explore the image.



Importing and Exporting – 3. Importing and Overlaying Vector Data

In this exercise you will import DXF Ordnance Landform Profile contours from the BGS corporate holdings and display them over the airphoto mosaic.

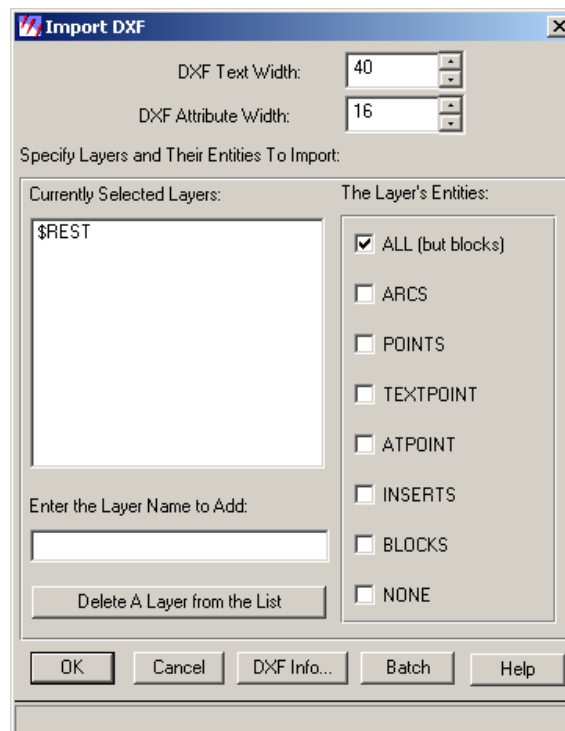
1. Click the **Import/Export** button on the IMAGINE Icon Panel



2. From the **Import/Export** menu ensure that the **Import** option is toggled and select the file **Type:** as **DXF to Coverage**, from the drop down menu. Now change the **Media:** to **File**.



Specify the **Input File** as *nc21sw.dxf* (path *E:\ERDAS_Training\Examples\Import_Export*) and the **Output File** as *nc21sw* to the same directory. Click **OK**.

The Import DXF dialogue box will open (as shown below). Ensure that the defaults are unchanged. Then click on **OK** to start the import.



Two folders forming an ArcInfo coverage will have been created in the Training folder, one called info and the other called nc21sw.

3. Open the airphoto mosaic from *E:\ERDAS_Training\Examples\Viewer\assynt_photo_mos.img* into a Viewer.
4. In the same viewer Go to **File > Open > Vector Layer** and select *nc21nw*. The contours will appear as black lines over the airphoto.
5. The contour line style (e.g. colour) can be altered using the Vector Properties

icon tool  accessible through the tools icon  in the viewer.

2 Module 3 - Subsetting

This module assumes knowledge of:

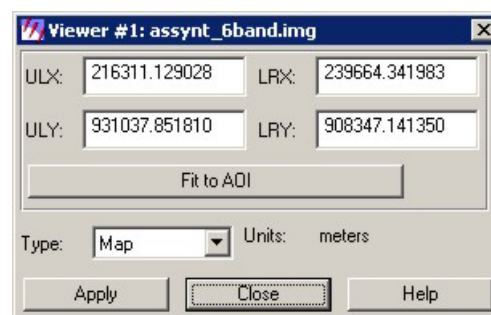
- Imagine Viewer

Subsetting allows the amount of data we are working with to be minimised by specifying a particular geographic area. By working with data that has a smaller file size it allows faster processing and display updates.

The Landsat mosaic of the Assynt area will be subset, producing a smaller size file for draping in the Virtual GIS module.

1. In a new viewer open *Assynt_6band* (path *E:\ERDAS_Training\Viewer*)
2. Go to **Utility > Inquire Box** or Right click with the mouse and select **Inquire Box**.

With the left mouse button, click and drag the red inquire box, you will notice the co-ordinates changing in the inquire box menu.




3. Specify the following area by typing in the co-ordinates in the inquire box menu:

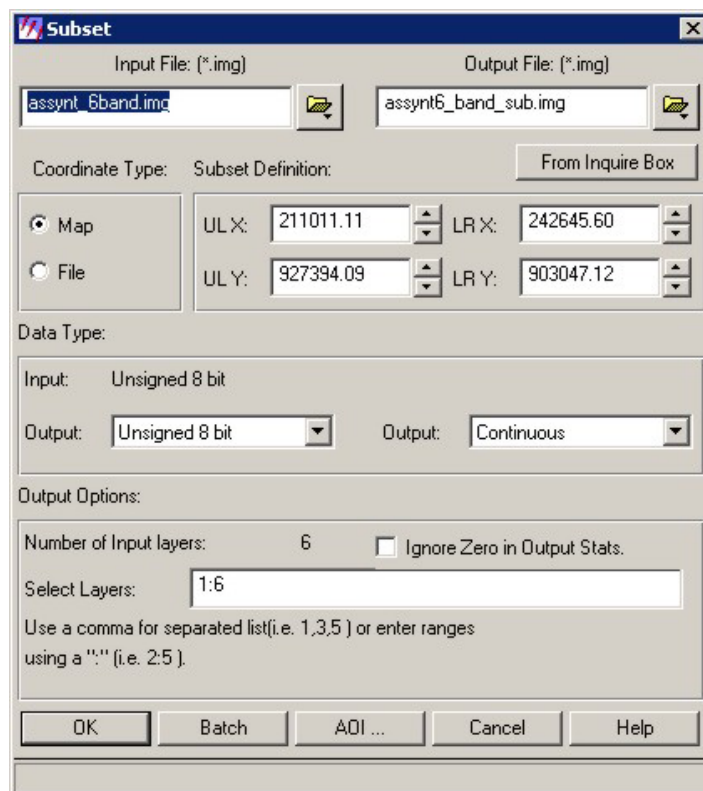
ULX 211000 LRX 242600
ULY 927400 LRY 903100

Then click **Apply**


The inquire box will have reshaped to fit these co-ordinates. Do not worry if the value of the co-ordinates have changed slightly. This is due to the inquire box snapping to the pixels of the pyramid layers, and is acceptable in this task.

4. Click the Data Preparation button from the IMAGINE toolbar  and select **Subset Image**.
5. The **Subset Dialog Box** will open. Specify *assynt_6band.img* as the input file (path *E:\ERDAS_Training\Viewer*) and *assynt6_band_sub.img* as the output file (path *E:\ERDAS_Training\Viewer*).
6. In order to update the subset definition co-ordinates from the inquire box click the **From Inquire Box Button**.

Note that if an exact subset is required the co-ordinates of the area can be typed directly in here, by-passing the inquiry box stage.



7. To run the subset click **OK**.
8. Once the process has completed open the subset in a new Viewer

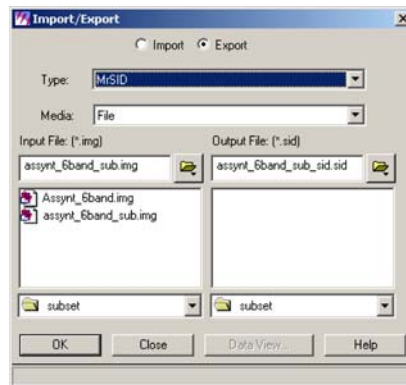
The process of subsetting a raster image is more streamlined via the GLT. The subset tool  in the 'General' portion of the window automatically opens the Inquire Box tool and Subset Definition dialogue.

Another approach to reduce the file size of an image is to save it in **MrSID** format. MrSID is a type of wavelet compression that can reduce file size by 10 to 20 times without noticeable loss of detail and the resulting files are compatible with most GIS software. As well as being able to display MrSID images, **IMAGINE** also allows images of 50million pixels or less to be saved as MrSID format.

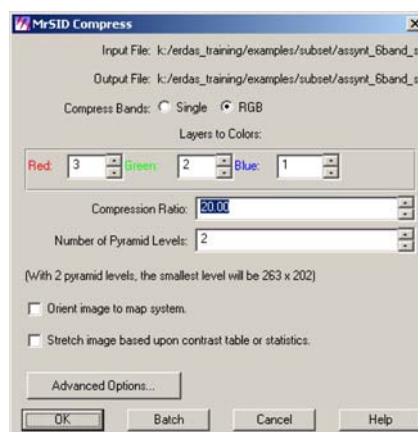
We will now use MrSID to compress the subset we have just created



9. Click the Import/Export button from the **IMAGINE** icon bar.
10. When the Import/Export menu opens, toggle **Export** and select the file type as MrSID.
11. Select *assynt6_band_sub.img* as the input file (path *E:\ERDAS_Training\Viewer*) and *assynt6_band_sub_sid.sid* as the output file. Click **OK**.



12. When the **MrSID Compress** window opens, change the layers to 321 RGB combination and set the compression ratio to 10 (this will give a compression ratio of 10:1). Click **OK**



13. Open the compressed image and the original image in separate viewers

You may need to save the breakpoints from the original image and then apply them to the compressed image to achieve similar contrasts.

14. Use Windows Explorer to compare file sizes between the two images.
15. Geo-link the viewers by right clicking in one and selecting **Geo. Link/Unlink** and then left clicking in the other viewer.

How do the images compare?

3 Module 4 - Mosaicing Images

This module assumes knowledge of

- ImagineViewer
- Band combination manipulation
- Breakpoint editing

Satellite imagery or airphotos that are georeferenced or orthorectified and have an overlapping area can be stitched together to create a seamless mosaic. Mosaics allow easy viewing of large areas, but the increase in file size will reduce the refresh rate during panning. Typically, mosaiced images are compressed or subset into tiles for use in a GIS or printed as fieldslips.

Mosaicing two georeferenced satellite images

To demonstrate the mosaic tool we will be using subsets from two georeferenced May Landsat 7 Images of the Shin Loch area of Scotland.

1. In a new viewer Open *E:\ERDAS_Training\Mosaic\206_19_subset.img* and *E:\ERDAS_Training\Mosaic\206_19_subset.img*. Ensure that the images are opened with a 321 RGB combination, with stretch and a transparent background.

The images have different contrasts and the overlap line can clearly be seen. The aim is to produce a mosaic with a consistent contrast and a smooth transition across the overlap area. There are several ways of doing this, one of which will be shown here.



Overlap line

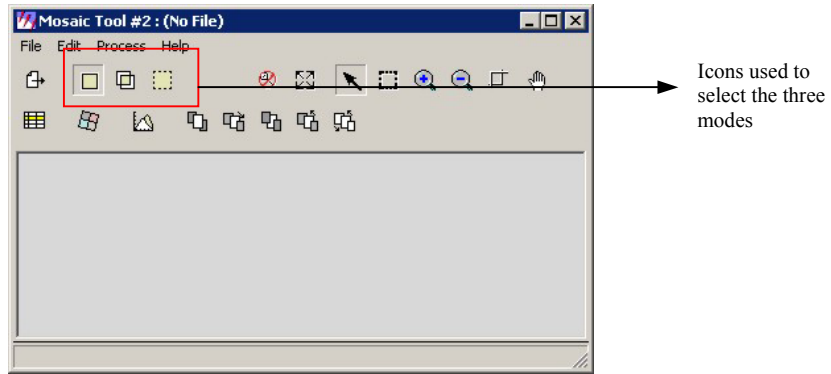
Decide which image has the better contrast (use **Utility > Swipe** to switch between the images). Make sure that the image that you have chosen is the top layer (**View > Arrange layers**) and open the **Breakpoint Editor** to manually match the contrast between images.


Save the breakpoints in *E:\ERDAS_Training\Mosaic\original_breakpoints.cbp*, these will be applied later to the mosaic that is created.


2. Click the Data Preparation button on the IMAGINE Icon Panel.

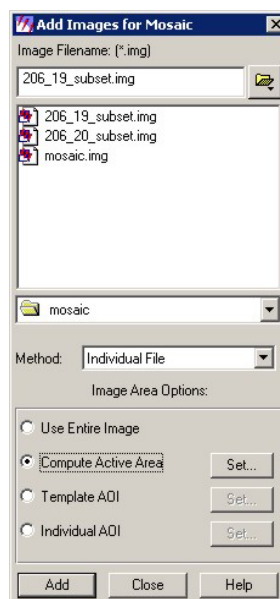


3. Select **Mosaic Images** from the data preparation menu and the mosaic tool viewer will open.

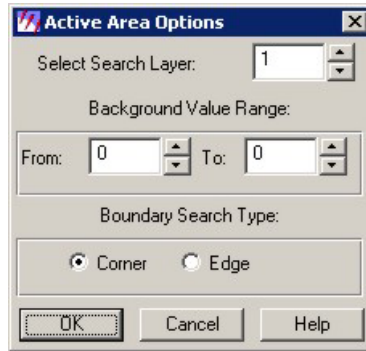


The mosaic tool has three modes, which are worked through progressively. Some of the icons displayed in the mosaic tool viewer will change depending on the mode. By default the **Set Mode for Input** tool is selected,  which allows the input files to be selected.

4. To specify the images to mosaic go to **Edit** then **Add Images**. This can shortcut by going to .
5. Once the Add Images dialog box has opened select *E:\ERDAS_Training\Mosaic\206_19_subset.img* as the image filename and toggle on the **Compute Active Area** button.



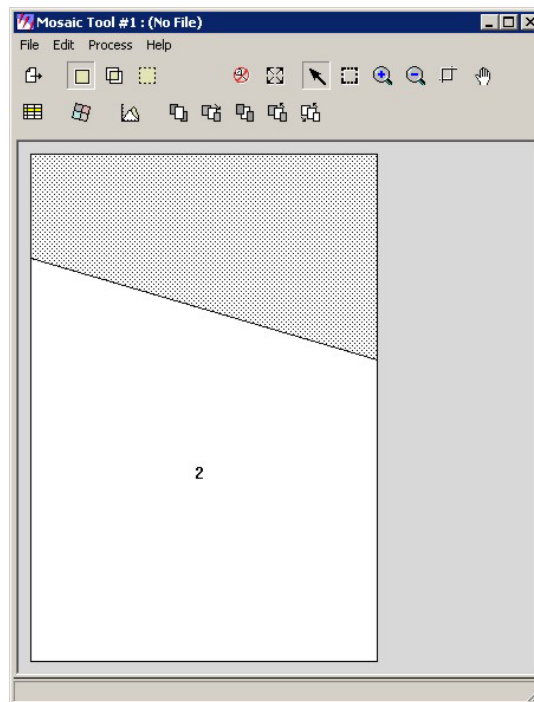
6. Click the Set button and from the **Active Area Options** dialog box specify the boundary search type as **Corner**, then click **OK**.




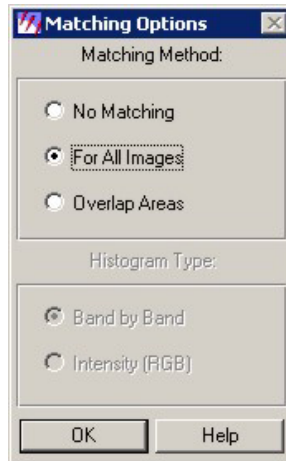
With an image that has an irregular boundary it is common to find black pixels surrounding the edge, effectively making the image square. These pixels need to be excluded from the mosaicing process, resulting in an 'active area' of useful data. The search will define the active area by ignoring pixels with a low DN value. In this case we are using the default of 0.

7. Click **Add** and the image outline will be displayed in the **Mosaic Tool Viewer**. Also add *E:\ERDAS_Training\Mosaic\206_19_subset.img*


The outlines of both images should now be displayed in the **Mosaic Tool Viewer**

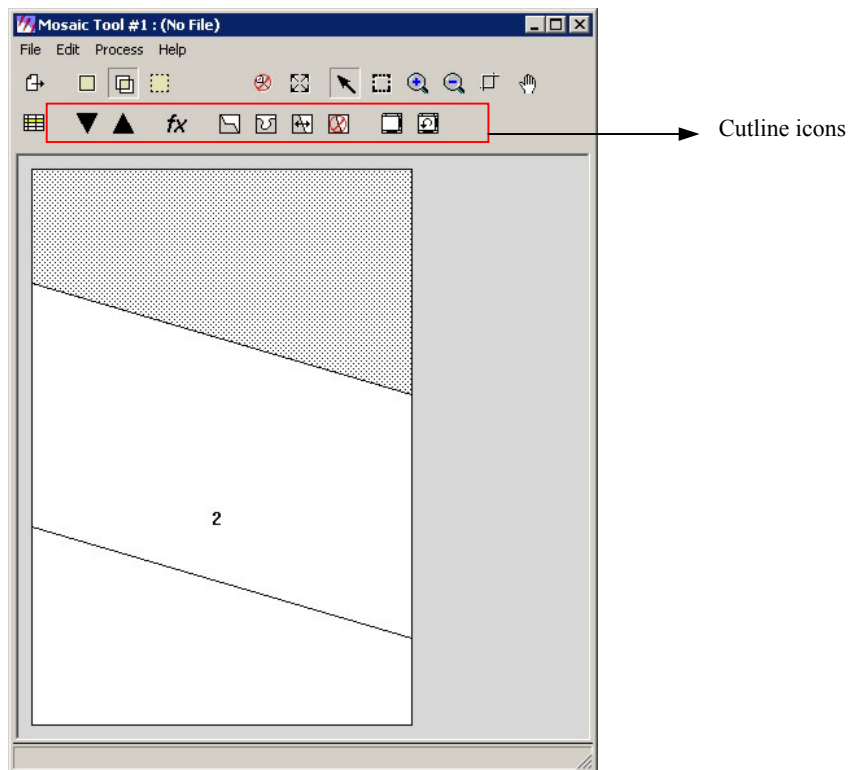


8. In order to obtain a similar contrast between the two images the contrast matching option can be used. This will hopefully remove obvious contrast variations in the final mosaic. From the **Mosaic Tool Viewer** go to **Edit** then **Image Matching**, or to shortcut click the **Display Image Matching Options** icon . The **Matching Option** Dialog box will open.




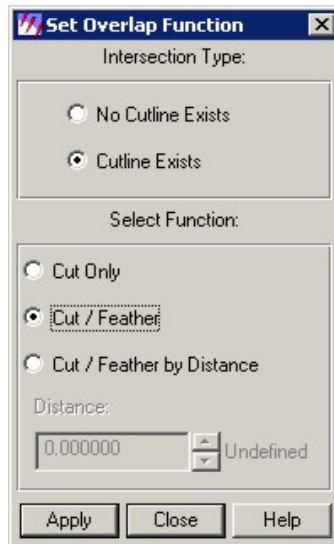
9. Toggle the **For All Images** option and click **OK**.




10. We are now ready to define how the images will intersect. Select the **Set Mode for Intersections** icon  from the **Mosaic Tool Viewer**. The cutline icons will now be displayed. A cutline can be thought of as a line which defines the point where the use of data from one image ends and where the use of data from an adjacent image begins.

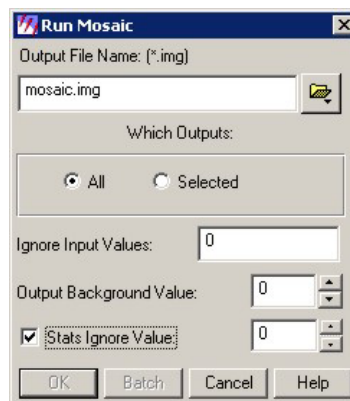


11. Click the **Set Default Cutlines for Intersection** icon . Default cutlines will be generated within the viewer.

12. From the Mosaic tool go to **Edit > Set Overlap Function**, or go to shortcut . Here we define how the images will intersect. Click the **Cutline Exists** option and the **Cut / Feather** function and then **Apply**. The feather function grades one image into another, smoothing the transition. **Close** the dialog box.



13. We are now ready to define the output mosaic. Select the **Set Mode for Output Images** icon  from the **Mosaic Tool Viewer**. Go to **Edit > Output Options** or go to shortcut . Ensure that the output pixel size is 30m and then click **OK**.
14. Go to **Process > Run Mosaic**. A **Run Mosaic** dialog box will open. In the **Input File Name** text box click on the folder icon  and type the filename *mosaic.img* in the following location: *E:\ERDAS_Training\Mosaic*



The **Stats Ignore Value** checkbox should be toggled and the value set to 0. Click **OK**

15. Open the mosaic in a new Viewer. The contrast of the image will appear too high, this is because a default stretch has been applied to the image.

Start the **Breakpoint Editor** and load the breakpoints that you saved earlier.



Take some time to inspect the mosaic, can you identify the seamline?

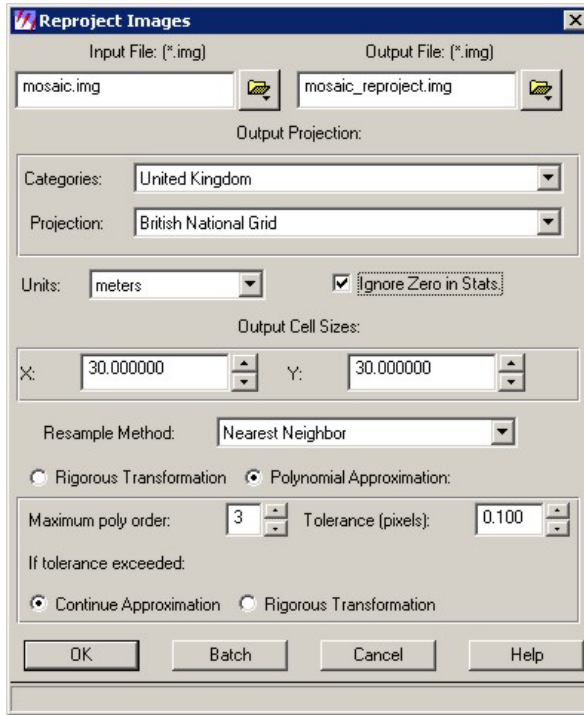
4 Module 5 - Reprojecting Image Data

This module assumes knowledge of:

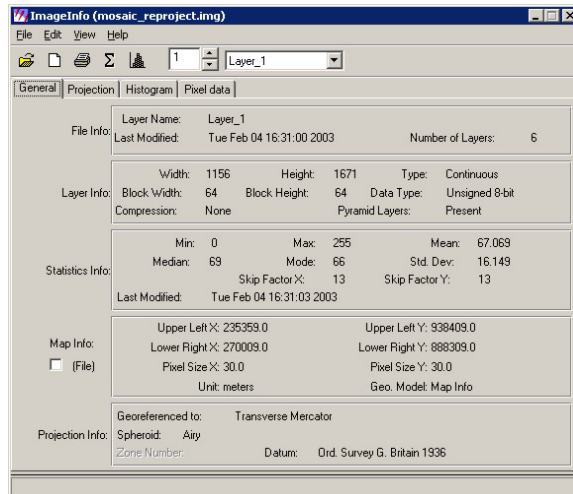
- Viewer

It is a commonly required task to reproject image data from one projection system to another. Imagine allows data in one projection system to be overlaid with data from a different projection system, by recalculating 'on the fly'. However other software such as ArcView requires data to be in the same projection system. In this module we will reproject data into British National Grid (BNG).

1. Open *E:\ERDAS_Training\Mosaic\mosaic.img* and open the **ImageInfo** dialog box. 
2. What Projection and datum does the image have?
Close the image info window.
3. Click the **Data Preparation** button on the IMAGINE Icon Panel. 
4. Click the Reproject Images button and select *mosaic.img* as the **Input File**. Specify *E:\ERDAS_Training\Mosaic\mosaic_reproject.img* as the output file.
5. In the **Categories** drop down menu choose United Kingdom and make sure that the **Projection** is British National Grid and the **Units** are meters. Click **OK**.



6. Once the process has run open the image in a new viewer and the **ImageInfo** dialog box to confirm that the image is now in Transverse Mercator projection with an Ordnance Survey 1936 Datum.




Q. How does this process differ from Stage 10 of “Importing and Exporting – 2. *Importing and Overlaying Raster Map Data*” on page 17?

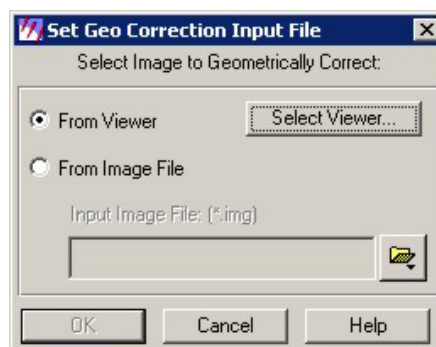
5 Module 6 -Geometric Correction

In this module we will be using the geometric correction capability in IMAGINE to geocorrect a Landsat 7 panchromatic band that has a 15m-ground resolution of the United Arab Emirates. The panchromatic band will be georeferenced to a certain extent based on ephemeris data but this can be improved by taking ground control points (GCPs) from maps and then resampling the image based on a polynomial transform.

1. In a Viewer open *uae_pan_togeo.img* (path *E:\ERDAS_Training\Examples\Geocorrect*). This is the Landsat Panchromatic image that will be geocorrected.
2. In the same Viewer open *uae_maps_for_geocor.sid* (path *E:\ERDAS_Training\Examples*). This is a mosaic of three maps from which we will be collecting GCPs and can be thought of as the reference image.
3. Use the **Viewer Swipe** (Utility > Swipe) to examine how the images overlay.

There is a noticeable offset between the two images.

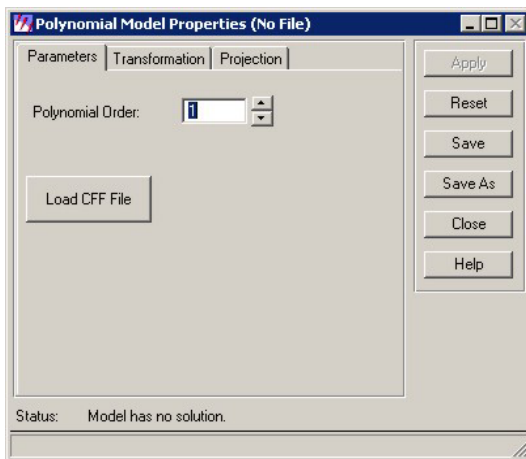
4. Remove *uae_maps_for_geocor.sid* from the viewer and open in a separate viewer.
5. Click the Data Preparation button from the IMAGINE toolbar  and select **Image Geometric Correction**.
6. The file to be geocorrected will now be chosen. From the **Set Geo Correction Input File** menu, ensure that the **From Viewer** option is toggled and click **Select Viewer**.



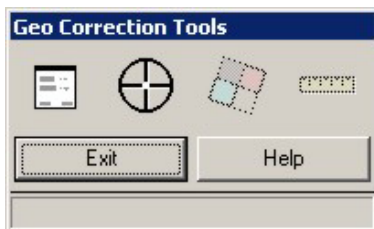
7. Follow the on screen instructions and left click in the viewer containing *uae_pan_togeo.img*.



8. The Set Geometric Model window will open. Set the Geometric Model to Polynomial and then click **OK**
9. The Polynomial Model Properties menu will open along with the Geo Correction Tools. The polynomial models is defined by the GCPs that will be collected.



Polynomial Model Properties Menu



Geo Correction Tools

Select the **Projection** tab from the **Polynomial Model Properties Menu** and click the **Set Projection from GCP Tool** button.

10. The GCP Tool Reference Setup menu will open. This menu allows us to choose which map or image from which we will be collecting reference control points. Make sure the **Existing Viewer** option is toggled then click **OK**.



11. When prompted left click inside *uae_maps_for_geocor.sid*.
12. The **Reference Map Information** window will open. This gives us information regarding the projection system of the image we are collecting GCPs from. Click **OK**.

13. A Number of Windows will open up, giving the general setup for collecting GCPs.

Close up of input image

Close up of reference image

GCPs will be collected from the input image from these two windows

GCPs will be collected from the reference image from these two windows

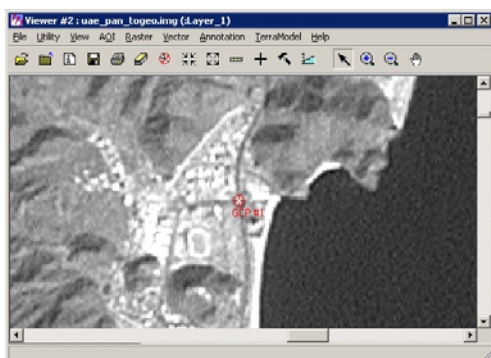
This white box can be moved around the image and controls the area visible in the close up view

This window, shows the GCPs collected and any errors present

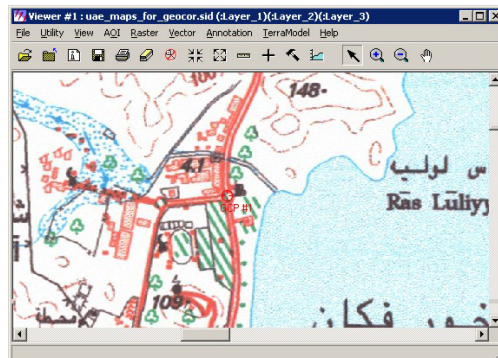
Point #	Point ID	Color	X Input	Y Input	Color	X Ref.	Y Ref.	Type	X Residual	Y Residual	RMS Error	Contrib.	Match
1	GCP #1	Red			Red			Control					

- In order to GeoCorrect the panchromatic band we need to find points that we can identify on both the reference map and the image. Non-dynamic features such as road intersections, or edges of large buildings make good GCPs as they are usually clearly identifiable and are generally constant over time. However in less developed areas, features such as bends in rivers or field boundaries may have to be used.

Use the inquire cursor to zoom into the road junction at the approximate positions: X= 434231, Y= 2805887 in the reference map window and X= 433800, Y= 2805880, in the window containing the panchromatic image.

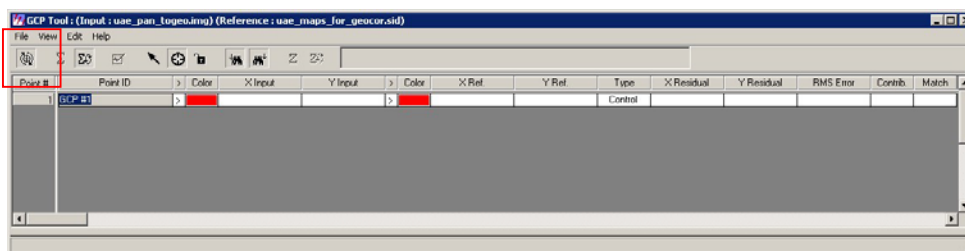


GCP 1



GCP 1

- In order to collect a GCP point the **Create GCP** button needs to be active on the GCP tool menu. Make this active now.

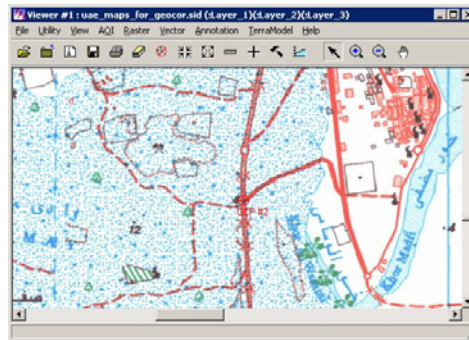
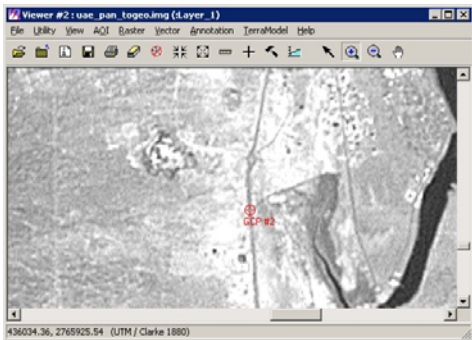


- Measure the point on both images by clicking with the left mouse button. You will have to reactivate the **Create GCP** button after the first measurement. It does not matter if you measure the point on the input or reference image first.

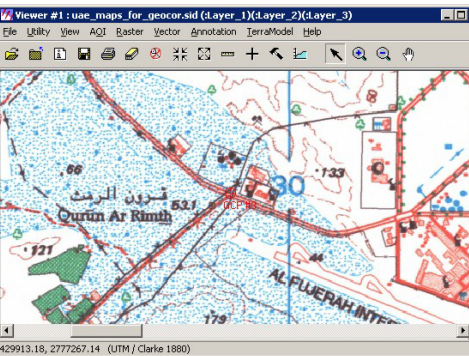
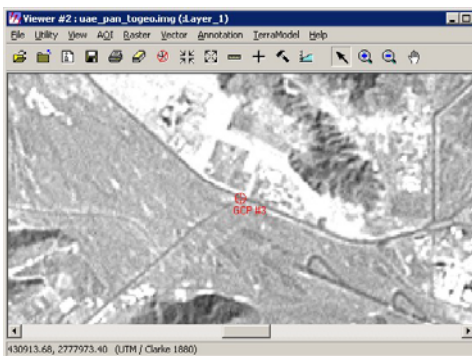
To reposition a point that has already been placed, click the **Select GCP** button from the **GCP Tool** and drag the point to its new location.

Notice how the co-ordinates have been automatically entered into the GCP Tool table.

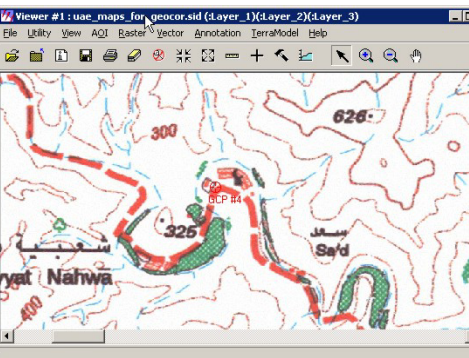
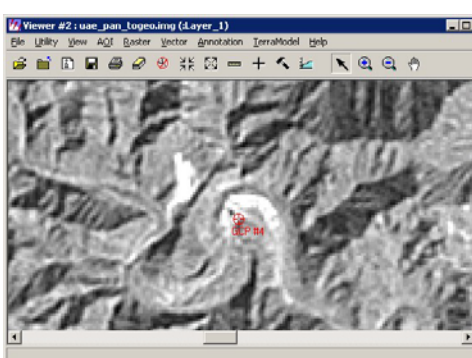
- Now identify and measure the following GCPs in the same way



GCP2 X=434139, Y=2767062 GCP2 X=434143, Y=2767123



GCP3 X=429180, Y=2777989 GCP3 X= 429527, Y= 2778332



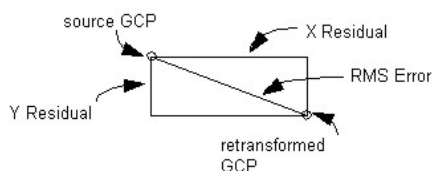
GCP 4 X=427654, Y=2794902 GCP4 X=427777 Y=2794879

When you measure the GCP4 on you will notice that IMAGINE predicted the location of the second point that was measured. This is a useful guide to positioning but should not be relied upon.

After the 4th point has been measured the Residuals and RMS values will be shown, these are measures of accuracy. The accuracy of the measured points can be calculated as only three points are needed to solve the polynomial, with the fourth point being assessed against these. In terms of residuals, this assessment is made by calculating the distance (X or Y) between the source co-ordinate and the retransformed co-ordinate based on the polynomial equations.


The RMS for the point can be through of as the combined X and Y error.

The relationship between residuals and RMS error per point is shown in the diagram below.



From ERDAS IMAGINE On-Line Help Copyright (c) 1982-1999 ERDAS, Inc.

The residual and RMS values are pixel measurements. Therefore, an RMS of 2 equates to 2 x 15m (the pixel resolution of this image) i.e. 30m possible error.

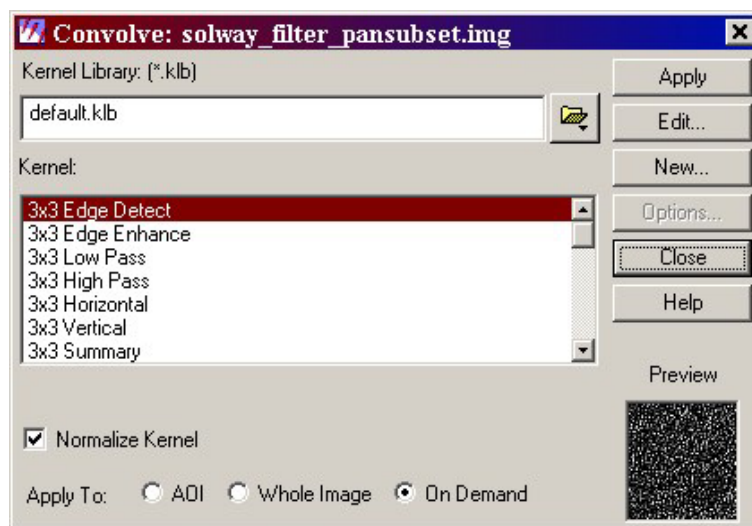
18. At this point it is recommended that that co-ordinates that have been collected are saved, in case you accidentally shut down the GCP tool. From the **GCP Tool** go to **File > Save Input As** and type in the file name as *input.gcc* (path E:/ERDAS_Training/Examples/GeoCorrect/). Also save the points collected from the reference image: **File > Save Reference As** and type the file name as *reference.gcc*.
19. Continue to collect 10 more points, making sure that you have a good spread of points across the image. Save the points every so often.
20. Try to reduce the RMS values so that they are less than 5 pixels for each point. However it is not worth positioning a point, in order to get low errors, if it is placed in an incorrect location as this will only lead to the propagation of errors through to the final geocorrected image. It is more important for the point to be in the right place than to get low residuals or RMS values. Start by re-observing the points that have the highest value in the **Contribution** column.
21. Once you are happy with the accuracy of the solution save the reference and input points and from the **Geo Correction Tools** dialog box click the **Display Resample Image Dialog** button.
 
22. When the resample dialog box opens, type in the output file as *uae_pan_geocorrected* (path E:/ERDAS_Training/Examples/Geocorrect) and click **OK**. The image will be resampled based on the control points that have been measured.
23. Close down all the viewers and geocorrection tools. When you are asked to save the current Geometric Model click **No**.
24. Open the geocorrected panchromatic image and the map in a new viewer. Again use the Viewer Swipe function to assess the accuracy of the geocorrection.

6 Module 7 - Filtering

Filtering is a form of image enhancement and is a method of increasing the amount of information that can be extracted from a given image. There are two main classes of image filters: low pass and high pass. A low pass filter will smooth an image by removing high frequency pixel value variations across an image, whereas a high pass filter will retain this high frequency variation, but remove low frequency variations. A high pass filter will therefore enhance edges and ‘sharpen’ an image.

In this module we will experiment with a number of filters on the panchromatic band of a Landsat 7 Image. This image was acquired during the winter under hazy conditions; since the panchromatic band covers a wide region of the visible spectrum it is particularly susceptible to atmospheric haze. Filtering is one of the techniques that can be used to reduce the effects of the haze by increasing contrast along tonal boundaries.

1. In a viewer open *solway_filter_pansubset.img* (path *E:\ERDAS_Training\filter*). You will see that the image has a ‘speckle’ like appearance. We are going to use the filtering tools to remove this ‘speckle’.
2. From the viewer toolbar go to: **Raster | Filtering | Convolution Filtering**. The dialog will open:



3. From the list under ‘Kernel’ select the 3x3 Low Pass filter.

For a low pass filter the 9 cells of the matrix all contain the value of 1 e.g.

1.0	1.0	1.0
1.0	1.0	1.0
1.0	1.0	1.0

When passed over the image each pixel is multiplied by each of the values in the matrix, if adjacent pixels have similar values then the relative difference will remain small after filtering, however if adjacent pixels have a larger difference in values then the multiplication by the filter values has the effect of reducing this difference by averaging out the pixel values. The filter is therefore averages out larger variations and ‘passes over’ small variations.

4. Before applying the filter to the image the user needs to decide whether they wish to permanently apply the changes brought about by the filter by using the 'Whole Image' option at the bottom of the dialog, apply it to a specified area of the image using an AOI, or just apply it to the image while they are working it using the 'On Demand' option. In this case we will apply it to the 'Whole Image' so select this option.
5. The image should now look smoother. Save the new image by selecting **File | Save | Top Layer As** from the **Viewer toolbar**. Save it to *E:\ERDAS_Training\filter\Solway_lowpass*.

We will now experiment with a few other filters to see their effects:

6. Re-open the original image as in step 1 above.
7. From the kernel menu in the convolution filtering dialog select the **3x3 High Pass** filter, this time apply the filter **on demand**.

A high pass filter has the opposite effect to the Low Pass filter and so highlights features with a high spatial frequency. Although the image now has a more 'speckle' like appearance, features such as roads and fence lines are easier to interpret. The matrix for a high pass filter looks like this:

-1.0	-1.0	-1.0
-1.0	9.0	-1.0
-1.0	-1.0	-1.0

The inclusion of a high value in the centre ensures that the high spatial variations are enhanced.

This area is famous for its glacial features, and we are going to interpret these later. It would therefore be useful if we could filter the image to enhance such features. From a preliminary examination of the imagery we can see that these features trend in a NE – SW direction. To do this we need to choose the appropriate filter.

8. From the Kernel list in the convolution filtering dialog select the **3x3 Right Diagonal Edge Detection** filter. This filter has the following matrix:

-2.0	-1.0	0.0
-1.0	0.0	1.0
0.0	1.0	2.0

This filter has been designed to highlight NE-SW trending edges, the three zero values run in this orientation and so no change will be made to pixel values in this orientation. However the matrix values in the upper left region of the filter are all negative – this has the effect of decreasing values on the NW side of the edge. The positive values on in the lower right have the opposite effect and so increase values to the SE of the edge; the combined effect is therefore to highlight NE-SW trending edges.

9. Apply this filter to the **Whole Image**, and save the results to *E:\ERDAS_Training\filter\Solway_diag_edgedet.img*. Analysis of the image indicates that some of the edges of the glacial features have been enhanced, however there are other edges (such as roads and fence lines) that have a similar orientation and so have also been enhanced. We will use this image later on the help digitise the crest lines of the Drumlins, but we will need additional sources of data.

Opening DTM data in the viewer

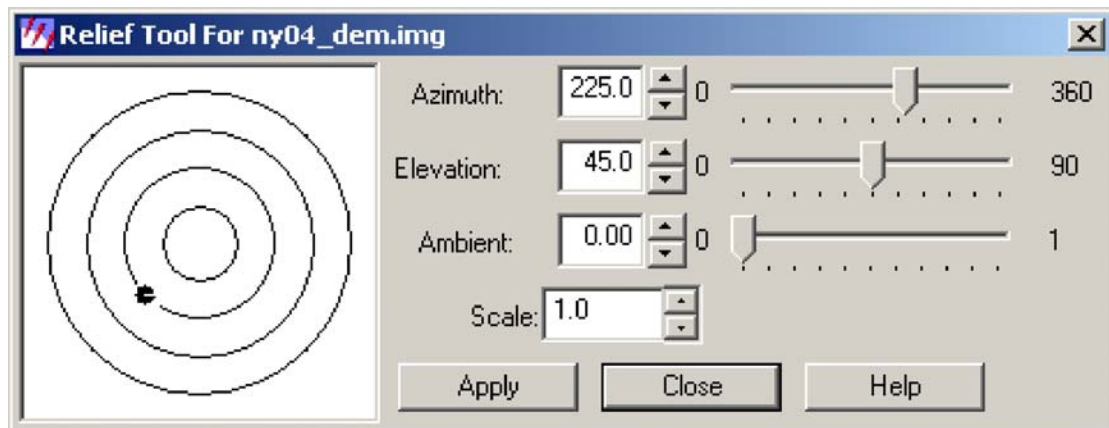
A very useful data source for the interpretation of surface features is Digital Terrain Models (DTMs). In Imagine there are a number of options that can be chosen when opening a DTM; these control how the DTM is displayed. In this exercise we will learn how to open the DTM as a greyscale image or as a shaded relief image. The relief display tends to be easier to interpret and has the advantage of allowing the user to explore different angles of shading.

We are going to use a CEH DTM. We will experiment with different sun angles, and then use the DTM, a 3 band false colour image of the area and the *Solway_diag_edgedet.img* you have created to digitise some of the drumlins in the Solway area.

10. In a new viewer navigate to **File | Open | Raster Layer** find the file *Solway_DTM.img* in the training folder. Highlight the file and click the **Raster Options** tab at the top of the dialog. Accept the defaults and click OK.

The DTM will display as a greyscale image; higher areas appear brighter.

11. Keep this viewer open, open a new viewer from the main IMAGINE tool bar.
12. In the new viewer repeat step 10, this time under the **Raster Options** tab select **Relief** for display as, and click OK.
13. In the second viewer select **Raster | Relief Shading Tool**, a dialog will open:



This tool allows you to choose how the DTM is displayed. The scale box increases the amount of detail shown in the display – it is recommended to increase this figure above 5.

Different lighting conditions will reveal different features. Three factors control the lighting; the Sun's Azimuth, Elevation and the Ambient brightness. Moving the dot in the concentric circles controls both the Azimuth and elevation; if the dot is moved to the centre the sun would be directly overhead, therefore no shading will be provided to the relief so the image appears white. A similar situation occurs if the dot is moved right to the edge of the circles, in this position no sun reaches the relief at all (rather like night time) and so the image appears completely dark. Good elevations to use tend to lie around 45° since this provides maximum shading and so maximum relief effects.

Moving the dot around the circles controls the sun's azimuth (the angle from which the light comes). This is useful as it reveals how a feature will look when illuminated from different angles.

14. Experiment with the controls within the relief tool to gain an understanding of their effects.

15. Once you have an understanding of these create an image which is illuminated from the SW (Azimuth ~ 220°) with a good scale. Go to **File | Save | Top Layer As** choose a suitable file name such as *Solway_DTM_SW.img* and save it to the E Drive.
16. Repeat step 15 but this time shade it from the SE. We will use both of these images for our interpretation.

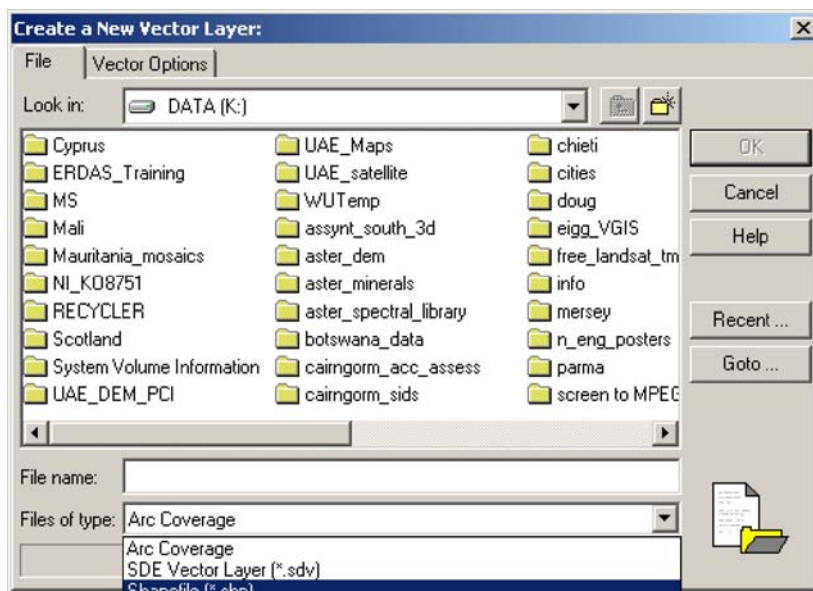
Interpreting glacial features in the Solway area

For this exercise we are going to interpret one type of glacial feature, namely the drumlins located to the south of the Solway Firth. We will use the 2 shaded DTMs, filtered image and a colour Landsat image as the four data sources.

17. Open 4 viewers from the ERDAS IMAGINE main tool bar.
18. Open your shaded relief images in two of the viewers, and the filtered image you produced earlier in the third. In the fourth viewer open the image *Solway_Lsat5_457.img*, a false colour Landsat 5 image of the area.
19. It is good practice to link the viewers together to ensure easy navigation, before doing this go to the main IMAGINE tool bar, select **Session | Tile Viewers** to get all four on the screen.
20. **Right Click** in the first viewer and select **Geo. Link/Unlink**, now **Left Click** in the second viewer to link it to the first, repeat this for the other two viewers so that all four are linked.


We now need to create a vector layer onto which we can digitise the crestlines of the drumlins.

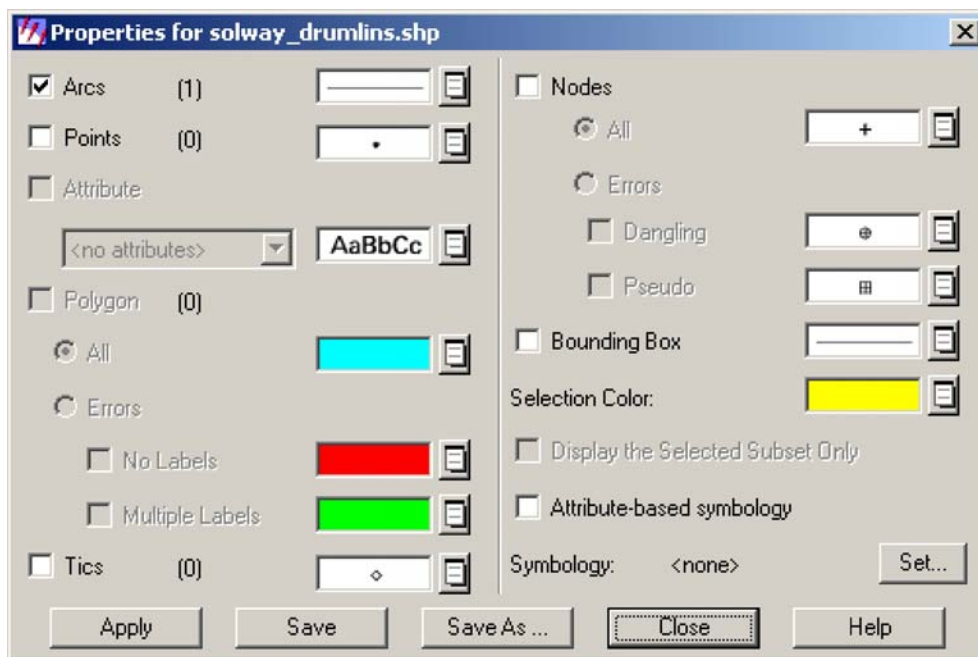
21. Make the viewer containing the false colour image the active window and from the Viewer menu select **File | New | Vector Layer**, a dialog as shown below will open. Locate the E drive directory and save the file as a **Shapefile** : *Solway_drumlins.shp*.
22. Set the Shapefile type to **Arc Shape**.



23. The vector tool pallet will open automatically.



24. To digitise a crestline, first locate one from one of or all four data sources. Then in the viewer with the vector layer, select the  tool from the vector tool pallet, left click at the start of the crestline, click once where you want to change line direction, and double click where you want the line to end. Repeat the process for each crest, ensuring to save the work as you go.
25. If you make a mistake, select the arrow tool from the vector tool pallet, click on the line to select it and then use the scissors on the tool pallet to remove the selected line.
26. You may want to change to appearance of the lines to make them easier to see against the backdrop; from the viewer menu **Vector | Viewing Properties**, this opens a dialog:



27. You are digitising Arc's, therefore to change the properties of these; click on the little notebook next to the line. Selecting 'other' from here gives a number of options for changing the line style and colour. Yellows and Cyan's tend to work quite well on the 457 false colour images.
28. When the colours etc have been chosen you will need to click apply then apply again, you will then be prompted to save the style to a file for later viewing, if you wish to do so give it the same name as the vector file.

Note: Rather than displaying each image in a different viewer, you can display them all in one viewer and rearrange the order in which they are displayed.

7 Module 8 - 3D Visualisation in Virtual GIS

This module assumes knowledge of

- ImagineViewer

Virtual GIS is a 3D-visualisation tool, which allows the integration and manipulation of DEMs, vector and raster layers. Flood layers and fly-throughs movies can also be created. In this module we will explore the main functions of the tool. The use of VGIS can be divided into three areas:

- Part 1 DEM manipulation
- Part 2 Draping raster and vector layers
- Part 3 Basic fly-through generation

Virtual GIS – Part 1 DEM Manipulation



1. Click the **Virtual GIS** button on the IMAGINE icon panel

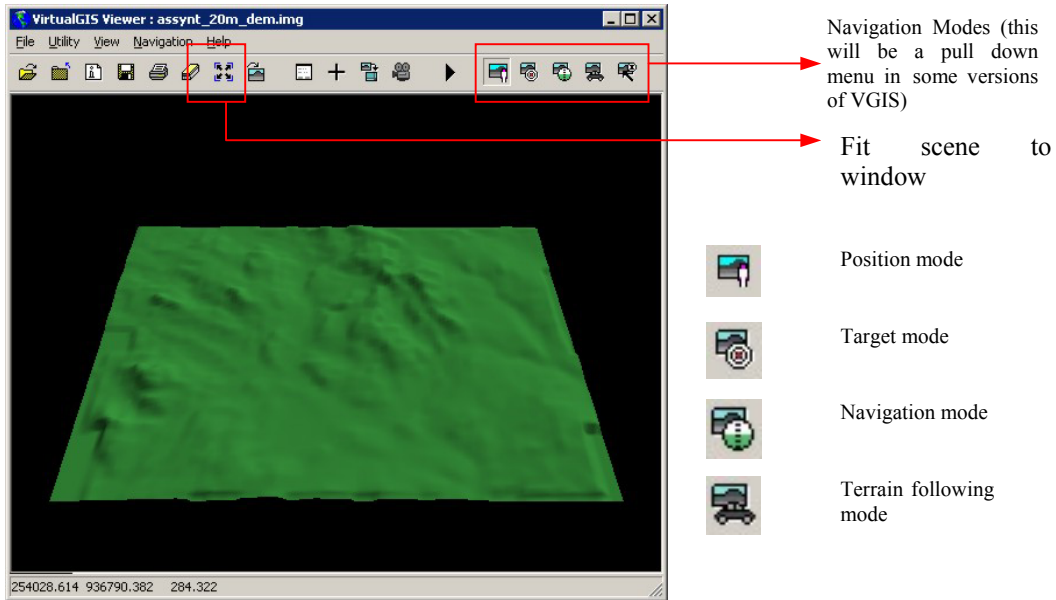
Select **VirtualGIS Viewer** from the **VirtualGIS** menu and a blank **VirtualGIS Viewer** will open (see figure on next page).

This viewer operates in a similar way to the normal 2D viewer but has some additional functions.

2. To display a DEM click on **File > Open > DEM** and navigate to *E:\ERDAS_training\Example\VGIS* and select *assynt_20m_dem.img*. The DEM must be in .img format. Click **OK**.

A perspective view of the DEM will display in position mode at low resolution. The DEM displayed has been generated from aerial photography and covers the Assynt area.

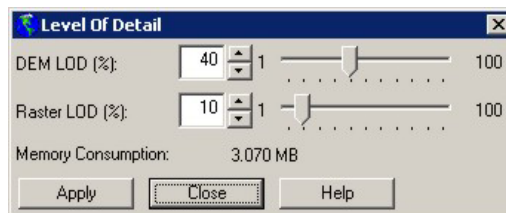
3. There are six navigation modes available for moving around the model. They are available from a pull down menu at the right hand side of the window. When set to **Target Mode** (a red cross will appear on screen) moving the mouse with the left button continuously depressed will enable the model to be rotated and tilted around the red marker. To change the location of the marker simply double click (left mouse button) somewhere else on the model. When set to **Position Mode** the model can be moved without rotation about any point. Using both of these modes is sufficient to navigate to any position on the model and view it from any angle. To zoom in or out of the image, hold the middle mouse button down and move the mouse either away from you or towards you. If you 'lose' the model simply click on **Fit scene to window** to refresh the screen and redisplay the model. *[The mouse settings may need to be adjusted in the control Panel so that the middle mouse button is set to 'middle mouse button' and not scroll.]*



You might want to also try the **Dashboard**, **Selection** and **Terrain following** mode (joystick is unavailable...)

- The DEM is currently displayed at low resolution; this is ideal for moving around the model. The detail shown by the model can be increased by going to **View > Level of Detail Control**.

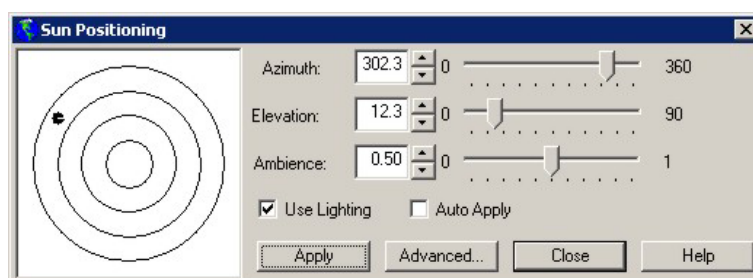
Unless a high spec graphics card is installed in the PC, it is advisable to navigate to the desired view while in low level of detail, and then to increase the amount of displayed data. Note that the DEM and raster layers can be edited independently.



Increase the **DEM LOD (%)** to 40. Click **Apply**. Wait until the viewer updates (this may take a few moments) and then click **Close**. Notice the extra information that is revealed.

- Altering the lighting conditions of the model, is a useful way of bringing out information within the DEM, such as drumlins or striations.

Click on **View > Sun Positioning**.

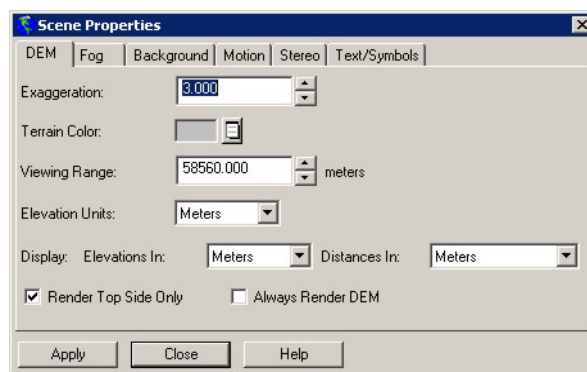


The **Azimuth**, **Elevation** and **Ambience** can be altered by clicking and dragging the pointers left and right. A quick way of changing the Azimuth and Elevation is by clicking and dragging the black dot around the 'target'.

Experiment with various sun positions.

6. Most of the model manipulation takes place in the **Scene Properties** dialogue box, found under **View**. This can be used to change the vertical exaggerations, motion speed, model colour, background type (e.g. a cloudy sky or night sky), add fog etc. and to generally add 'realism' to the model.

Explore the various options, try increasing the vertical exaggeration, introducing fog, changing the terrain colour and adding a fade colour background.



Virtual GIS – Part 2 Draping raster and Vector Layers

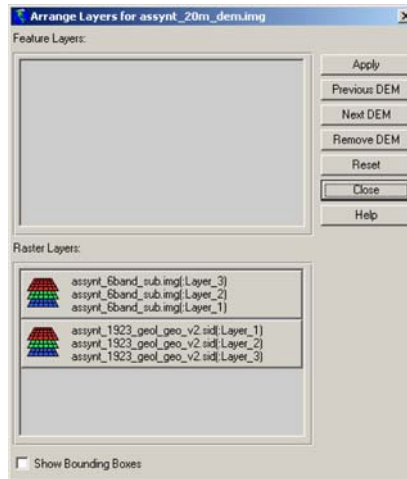
1. Raster imagery in greyscale, true colour or pseudo colour can be draped onto the 3D model as long as they are projected to the same co-ordinate system. The raster file is selected by navigating through **File > Open > Raster Layer**.

Navigate to *E:\ERDAS_Training\Examples\VGIS* and open the file *Assynt_6band_sub.img* as a True Colour 321 image. The Landsat image will be draped over the model.

Try different levels of detail for the raster overlay and the DEM.

2. Repeat the process and drape over *assynt_1923_geol_geo_v2.sid* from the same directory. This is a geocorrected geological map of the area.
3. Ideally we would like to see both the geology and the satellite image simultaneously to explore the relationships between the relief and the two raster layers. In order to do this we can blend the two layers.

Go to **View > Arrange** layers and drag the Landsat image so it is above the geology raster by clicking and dragging with the left mouse button. Select **Apply**.



4. Go to **View > Blend** (8.4) or **Utility > Blend** (8.5) and set the **Blend Fade** to 50%.

Zoom in experiment with different blend percentages.

5. Remove the geology layer before we add the vector layer

Navigate through **View > Arrange Layers**, and right click on the geology raster in the Arrange Layers dialog box. Select **Delete** and then **Apply** the changes.

(It maybe necessary to reset the blend percentage to 100% if the image appears dark)

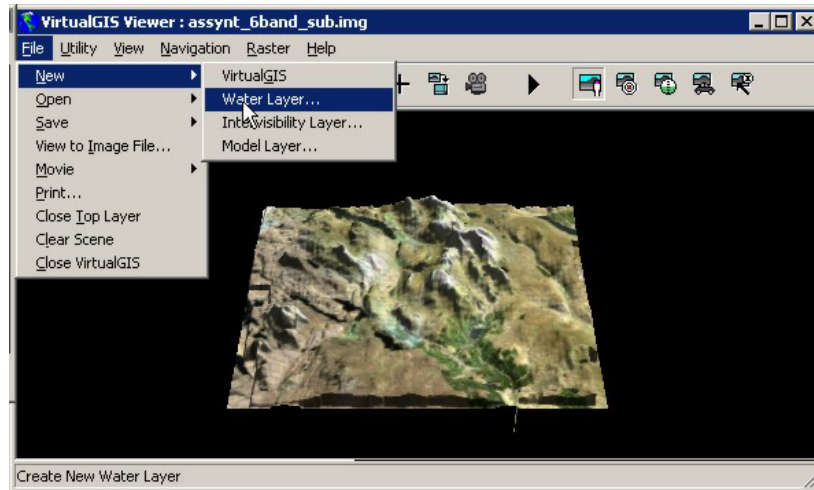
6. IMAGINE will display ArcInfo coverages and ArcView shapefiles without the requirement to import them. However, there are a number of bugs when displaying shapefiles, therefore it is often preferable to import these prior to draping. ERDAS uses ArcInfo coverages as its native format, along with 'annotation layers', 'overlay layers' and 'areas of interest' files.

To display the vector file navigate through **File > Open > Vector**, and choose the arc coverage file *E:\ERDAS_Training\Examples\VGIS\geol_lines*.

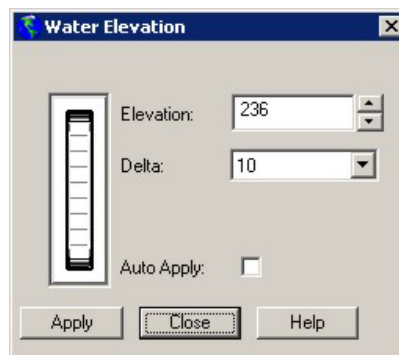
ERDAS will compute a drape file (*.drp). Sometimes sections of linework are hidden under the 3D model and in these cases it is advisable to offset the vector files from the terrain using the **Layer Offsets** tool in the **View** menu.

7. Now we will create a flood layer within the viewer. As well as being a useful tool in flooding studies the flood layer can be used to study elevation changes across the model.


Click **File > New > Water layer**. When prompted to enter a file name Navigate to *E:\ERDAS_Training\Examples\VGIS* give the filename *flood.fld*. Click **OK**.



8. A new menu header with the title **Water** will appear in the VGIS Viewer. Select on this header and click **Fill Entire Scene**. The water layer will be generated at a default height.
9. To alter the elevation of the water layer navigate through **Water > Water Elevation Tool**.



By clicking and dragging the thumb wheel, typing in, or using the up/down arrows the desired elevation can be achieved.

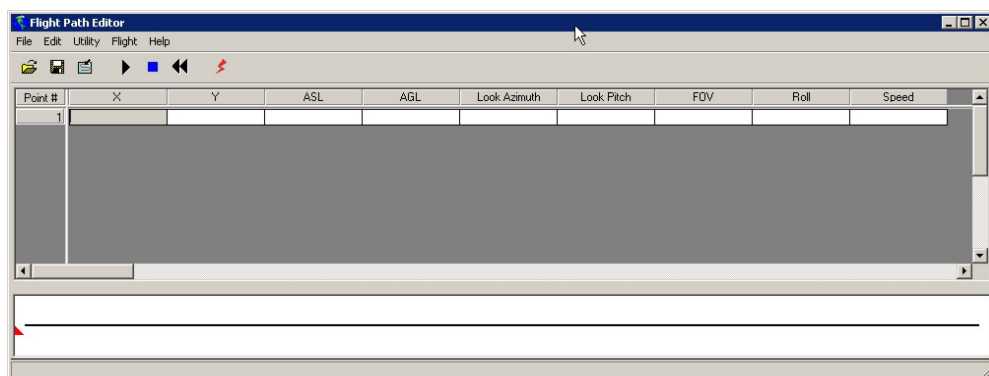
11. Also try adding **clouds**, **mist**, and various **backgrounds** etc.
12. The flood layer etc. will be removed before we generate the fly through. Click the **Close Top Overlay Layer** 
13. When you have your model set up on screen, complete with raster/vector overlays as desired, you can save it as a VirtualGIS project which will save you from reconstructing the model and overlays each time. Save the project now.

Select **File > Save > Project As**. Navigate to *E:\ERDAS_Training\Examples\VGIS* and save the project as *assynt_3d.vwp*.

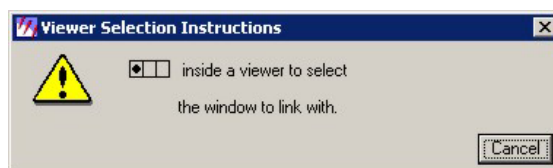
Virtual GIS – Part 3 DEM Fly Through Generation

1. The first stage in producing a fly through is to digitise a flightpath.

Click **Navigation** in the VirtualGIS viewer and select **Flight Path Editor**. The **Flight Path Editor** window will open.

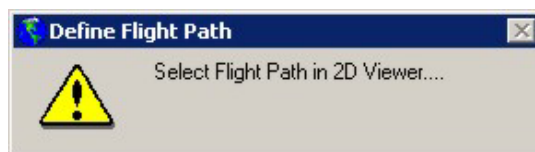


2. Flight paths are digitised from a normal 2D viewer. Open the file *Assynt_6band_sub.img* (path *E:\ERDAS_Training\Examples\VGIS*), in a new viewer.
3. From the Flight Path Editor select **Utility > Digitise Flight Path**
4. The **Viewer Selection Instructions** window will open.

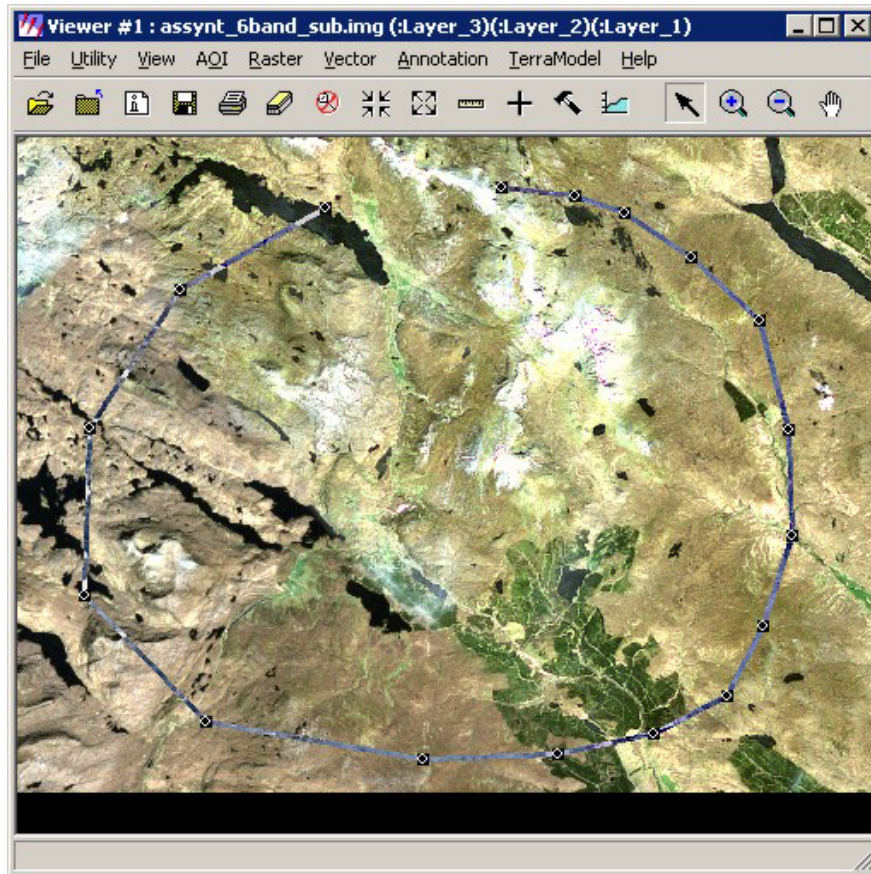


Follow the instructions and click with the left mouse button in the 2D viewer containing *Assynt_6band_sub.img*. This will link the viewer to the Flight Path Editor.

5. A **Define Flight Path** menu will open.



Digitise a flight path in the viewer by clicking the left mouse button and defining a number of points. You may want to start initially with a simple circular flight path. Double click to end the path.



6. Now go back to the flight path editor menu. You will see that positional information has been taken from the digitised flight path, and has been added to the table, as well as some default altitude and attitude information.

To apply these changes to the flight path, click the **Add Changes to Flight Path Button**  and the flight path will appear at the bottom of the menu.

Point #	X	Y	ASL	AGL	Look Azimuth	Look Pitch	FOV	Roll	Speed
1	222423.000	924801.700	992.00	913.00	0.00	0.00	45.00	0.00	20.00
2	217042.500	921763.300	992.00	727.00	0.00	0.00	45.00	0.00	20.00
3	213687.600	916636.000	992.00	879.00	0.00	0.00	45.00	0.00	20.00
4	213497.700	910432.600	992.00	896.00	0.00	0.00	45.00	0.00	20.00
5	217992.000	905748.400	992.00	792.00	0.00	0.00	45.00	0.00	20.00
6	226031.100	904355.800	992.00	577.00	0.00	0.00	45.00	0.00	20.00
7	231031.800	904545.700	992.00	760.00	0.00	0.00	45.00	0.00	20.00
8	234576.600	905305.300	992.00	857.00	0.00	0.00	45.00	0.00	20.00
9	237298.500	906697.900	992.00	683.00	0.00	0.00	45.00	0.00	20.00
10	238627.800	909293.200	992.00	493.00	0.00	0.00	45.00	0.00	20.00

7. To start the flight click the **Start Flight button** .

The flight may appear to be very slow. The smoothness and speed of flight is depend on a number of factors:

- The size of the VirtualGISViewer (a smaller viewer - faster).
- The detail level of the DEM and overlays (lower detail – faster).
- The flight speed (m/s) set in the Flight Path Editor (Higher speed – faster).
- How powerful the PC is.

Try altering the first three factors to achieve a reasonably fast flight. Don't worry if it appears 'jerky' or if you need to reduce the level of detail significantly – we are really just making sure the flight path is reasonable. The flight will be smoothed out during the creation of the final movie and the level of detail can be increased to maximum just before the movie is generated.

To return to the start of the flight path click the **Reset to Beginning of Flight Path** button



To stop the flight click the **Stop Flight** button



After making any changes in the Flight Path Editor ensure that the Apply changes to flight Path button is clicked

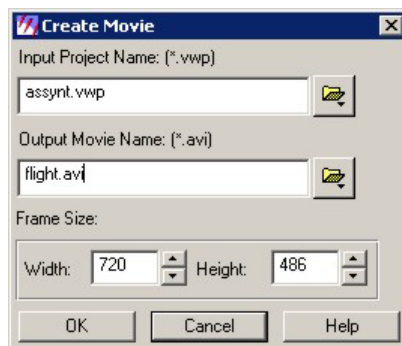


8. The Flight Path Editor table is interactive and the attitude and altitude information can be altered to achieve a more visually impressive or useful flight. Take to some time to experiment with the various options:

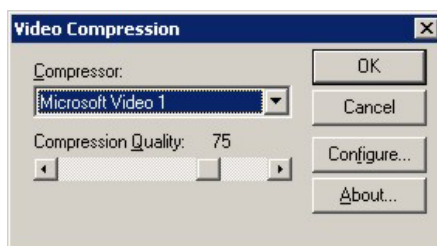
- The flight path positional information can be altered most simply by moving the nodes of the flight path in the 2D viewer. This will change the X and Y positions in the **Flight Patch Editor**. If you are good with co-ordinates they can be typed in directly
- To change the height (in m) of the flight change the Above Sea Level (**ASL**) or above Ground Level (**AGL**) edit the table values.
- The **Look Azimuth** defines the direction you are looking from the plane. Zero is straight ahead, 90 degree is directly to the right, 180 degrees is directly behind etc.
- The **Look Pitch** defines where the nose of the plane is pointing, a negative pitch will be looking down and positive pitch looking up (a look pitch of -10 tends to work well).
- The **Roll** defines the relationship of the plane to the horizon. A 45 degree roll will be a 45 degree roll to the right.
- The **Speed** (in m/s) defines how fast the flight is, although this is generally not a true value as the power of the computer is also relevant. A value of 400 will work well on a slow machine, a lower value will be needed on a faster machine.
- The **focal point** dictates where the viewer looks during part/all of the flight.

9. Once you are happy with the flight, save the flight path by selecting **File > Save As**, and save as *flight.ft* (path E:/ERDAS_Training/Examples/VGIS/), in the **Flight Path Editor**.

10. At this point also save the Virtual GIS Project. Increase the level of detail of the DEM and raster overlay to maximum. In the Virtual GIS viewer go to **File > Save > Projects as...** Navigate to *E:\ERDAS_Training\Examples\VGIS* and save the project as *assynt_3d.vwp*. Click **Yes** to overwrite the existing file.
11. Close down all the viewers.
12. In order to create a movie from the flythrough. Click the **Virtual GIS** button on the IMAGINE icon bar and select **Create Movie**. Select the Virtual GIS project and save the output movie as *flight.avi* in *E:\ERDAS_Training\Examples\VGIS*. Click **OK**.

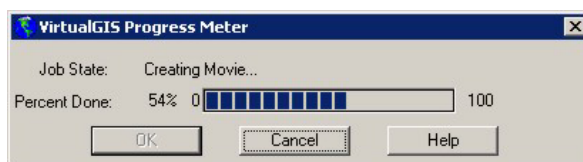


13. From the Video Compression window, select the **Compressor** as **Microsoft Video 1** and click **OK**.



The movie will now be generated, which may take a few minutes to create, depending on the length of your flight and the flight speed.

If progress is very slow you may want to cancel the operation and increase the flight speed (e.g. 400), this will reduce the number of frames generated and speed up the creation of the movie.



13. Using **Windows Explorer** to navigate to the location of the video and double click. The movie should open and play.

If you have time, try improving your fly-through.

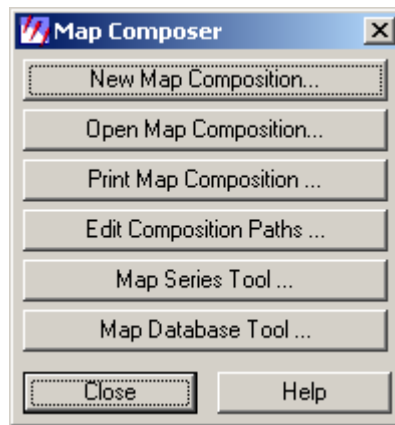
Module 9 - Creating Map Compositions

Plots are produced in IMAGINE by creating a Map Composition which has the functionality to add tiles, scale bars and gridlines much as the Layout window works in Arc.

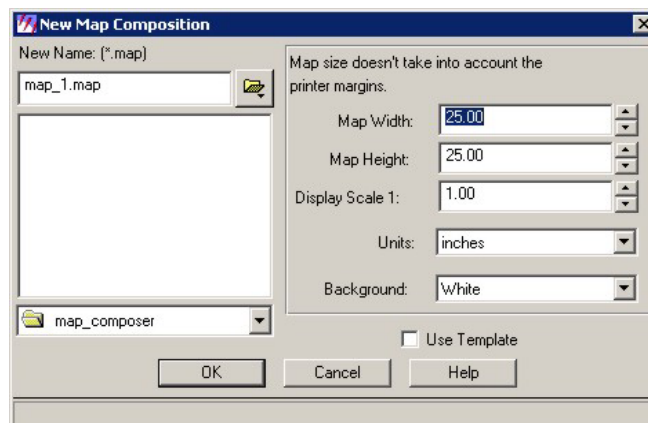
In this module we will produce a map composition based on data from the Assynt area. A shapefile vector layer will also be created.



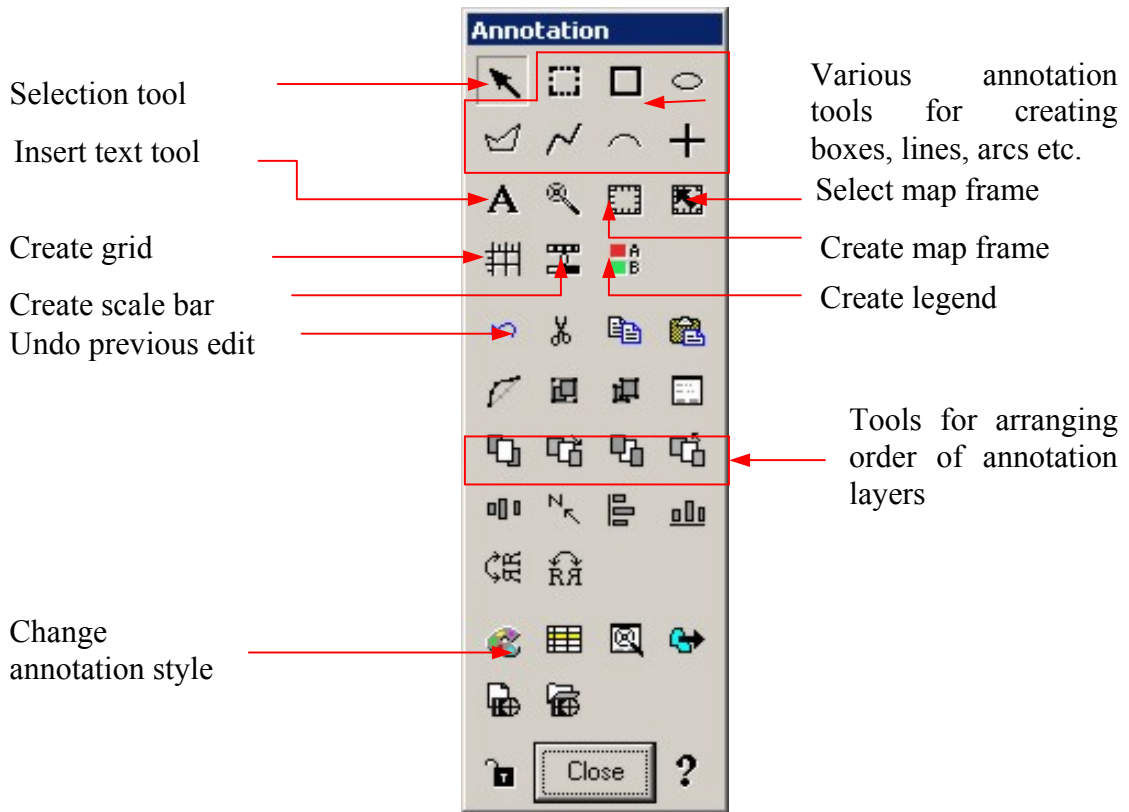
1. From the IMAGINE icon tool bar select the **Map Composer** button
2. Select **New Map Composition** from the **Map Composer** dialog box




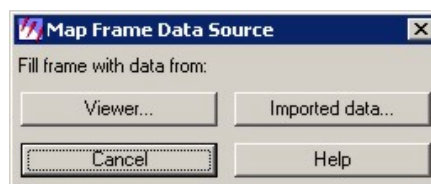
3. When the **New Map Composition** dialog box opens type *map_1.map* as the **New Name** and specify the map width and height as 25 inches, then click **OK**. This will be the size of the composition.



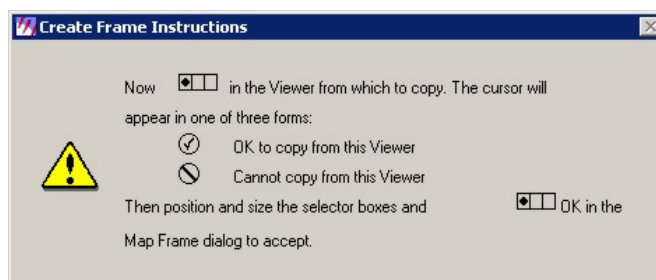
4. A **Map Composer** window will open together with an **Annotation** tool Bar. The main functions of the toolbar are shown below but please note there might be slight variations due to the version of Imagine that you are running.



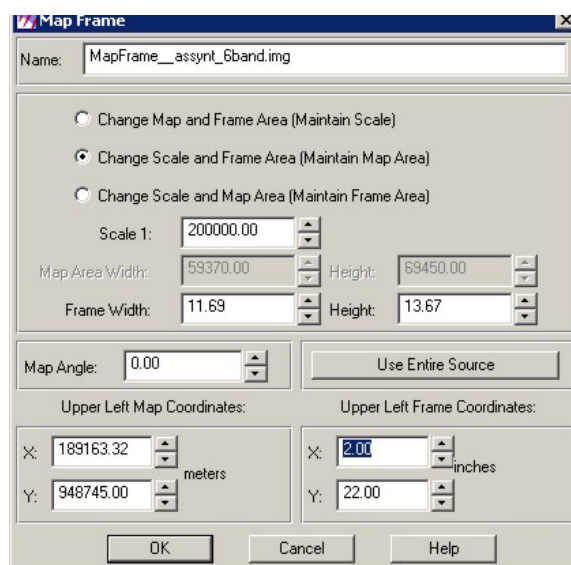
5. In a normal IMAGINE viewer open *assynt_6band.img* (path *E:\ERDAS_Training\Examples\Viewer*) in a 321 combination.
6. To insert this image into the map composition click on the **Create Map Frame** button on the **Annotation** tool bar  and hold down the left mouse button to drag a rectangle in the map composer window.
7. From **Map Frame Data Source**, click **Viewer**.




8. Follow the **Create Frame Instructions** and click inside the viewer containing *assynt_6band.img*

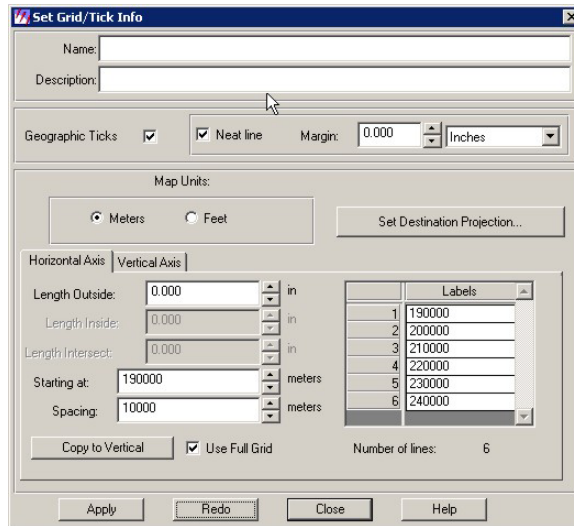


9. The **Map Frame** dialog box will open. This menu is used to define the size, scale and position of the image within the map composition.



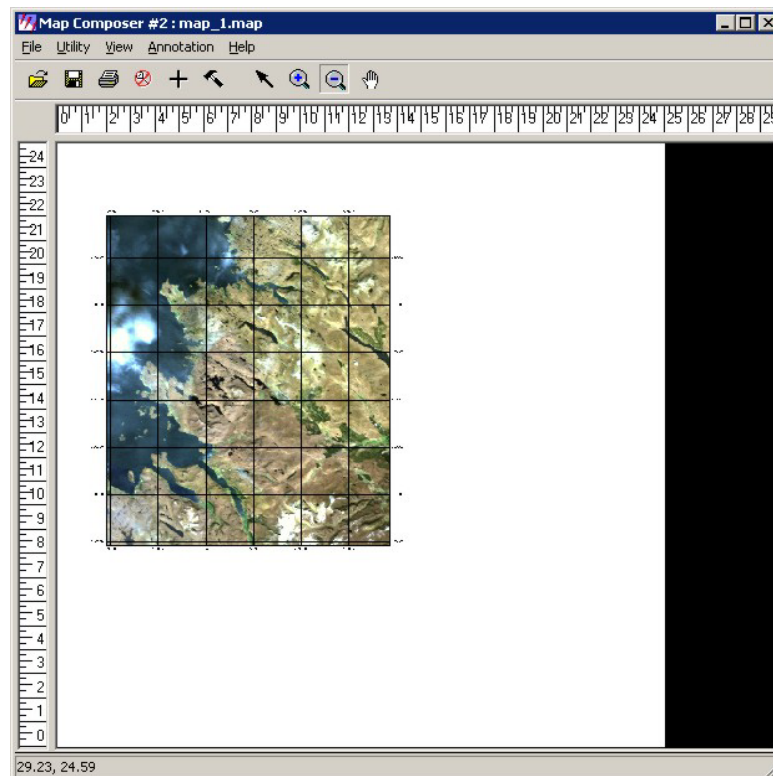
You will notice that a white box has appeared in the viewer that was just selected. This defines the area of the image that will be used in the map composition. As we want to use the whole image click the **Use Entire Source**. The white box has now increased in size to incorporate the whole image.

10. Now change the scale. In the box adjacent to **Scale 1**: type in 200000.
11. The final stage is to define where the image will appear in the map composition. In the two boxes below **Upper Left Frame Coordinates**, change the values to X=2 and Y=22. This will position the image in the top left-hand corner of the composition. Click **OK** to insert the image.
12. The next step is to create a grid over the image with co-ordinates around the edge. First click the **Create Grid Ticks** button on the Annotation toolbar  and the mouse icon will change to the select map frame symbols. Now click inside the image within the **Map Composer** window.
13. The **Set Grid/Tick Info** menu will appear. This menu allows the spacing of the grid and the labels around the edge of the image to be defined.



Change the **Horizontal Axis** spacing to 10000 meters and toggle on the **Use Full Grid**. This will give a grid line every 10km. To copy this to the vertical axis click the **Copy to Vertical** button.

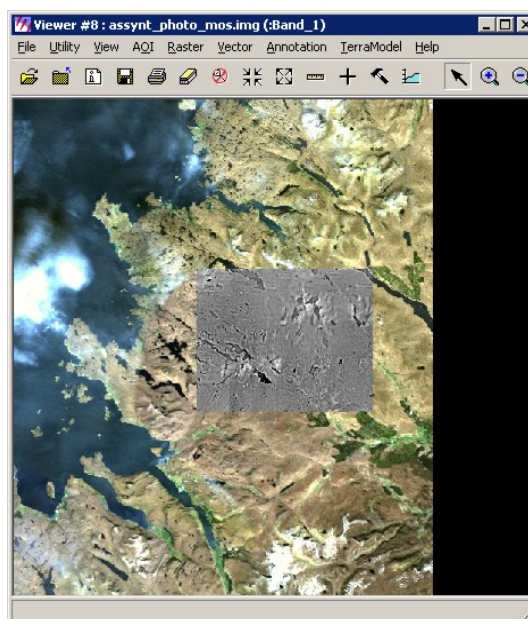
14. Click **Apply** then **Close**. Your map composition should now look like this:



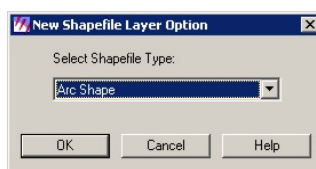
15. Open a new **Viewer** and add *assynt_photo_mos.img* (path *E:\ERDAS_Training\Examples\viewer*).
16. Inset this image to the map composition the same way as the previous image, but this time specify the scale as 1:125000 and the upper left coordinates as X = 3 and Y = 7.
17. Add a full grid to the image, this time with a spacing of 5000m.


18. We now have a satellite image of the Assynt area together with an airphoto image. In order to show what area the airphoto covers, a shape file can be digitised then overlaid on the satellite image, in the map composer.

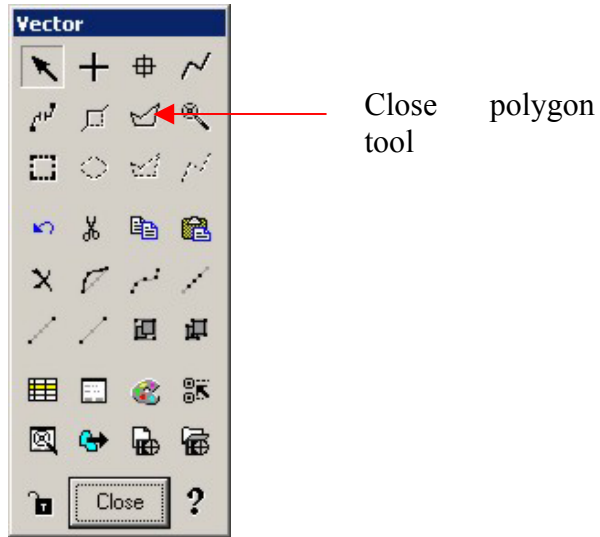
Open both *assynt_6band.img* and *assynt_photo_mos.img* in a **Viewer** and arrange the layer to ensure that the *assynt_photo_mos.img* is the top layer.



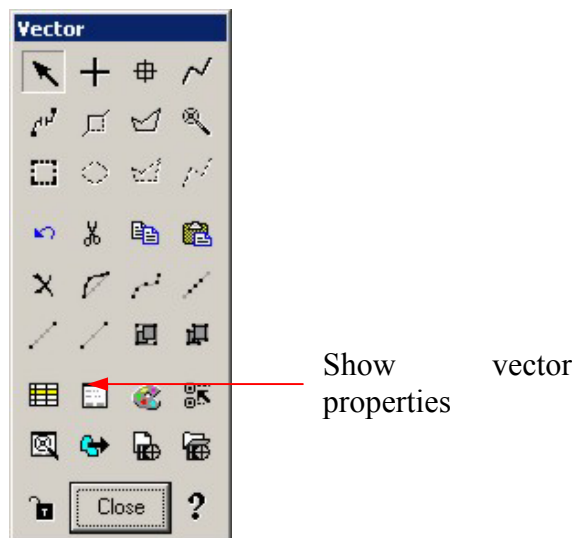
19. Go to **File > New > Vector Layer**. When the **Create a New Vector Layer** menu opens navigate to *E:\ERDAS Training\Examples\Map_composer* and enter the file name as *photo_mosaic_outline.shp*. Click **OK**. Note: the 'double image' above can also be inset into the composer.
20. From the **New Shapefile Layer Option** make sure the Shapefile type is set to **ARC Shape** and click **OK**.



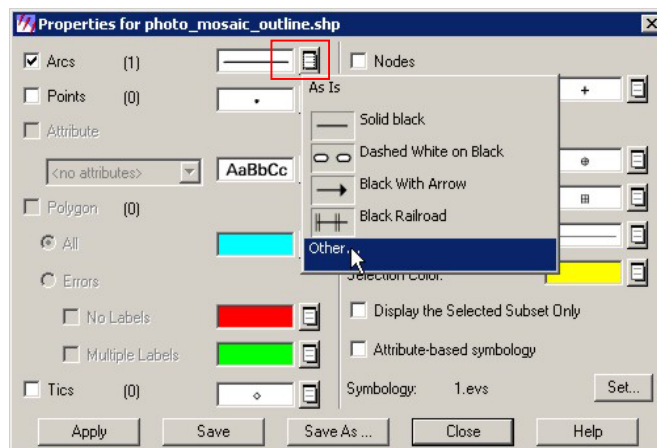
21. Click the **Vector Tool Palette** button  from the **Viewer Tool Bar** and then select the **Close Polygon Tool**.



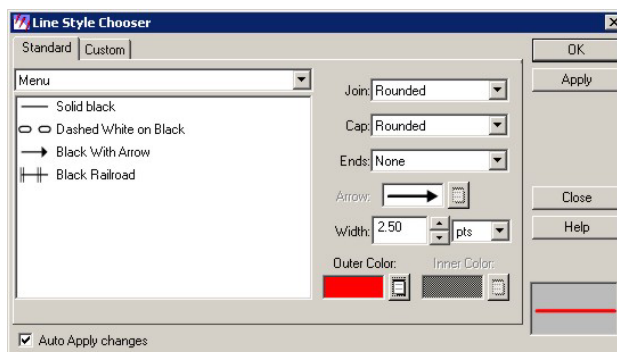
22. Using the left mouse button digitise a square around the outline of the air photo mosaic. It doesn't matter if it is not perfectly accurate.
23. We now need to change the line properties to make it more obvious. Click the Show Vector Properties button from the Vector Tool Palette.



24. Click on the Arcs properties button to change the line style, and click **Other**.




24. The **Line Style Chooser** menu will open. Change the **Outer Colour** to red and the **Width** to 2.5 pts. Then click **OK**

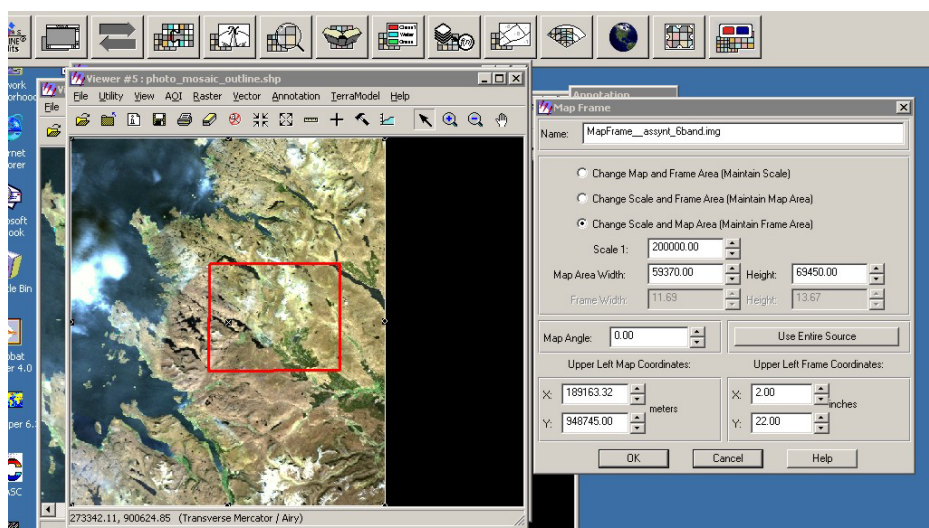


25. When you are returned to the **Properties** for *photo_mosaic_outline.shp* menu, click **Apply** and then **OK**.

The box you have digitised will now be red.

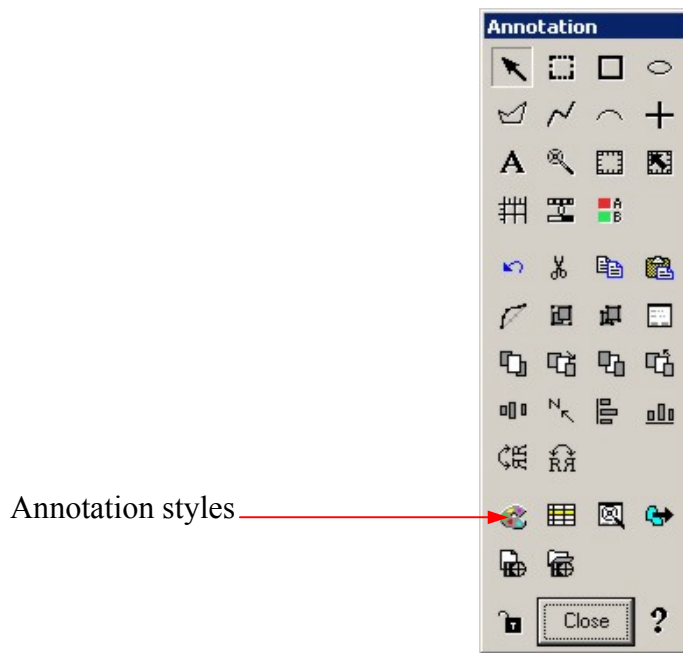
26. We now want to update our map composition and overlay this shapefile on the satellite image. In order to do this without re-inserting the image click the **Select Map Frame** button  from the map composition annotation tools and double click the satellite image in the map composer.

27. A new viewer will open containing the satellite image and a **Map Frame** dialog box. In the new viewer, open the shapefile that you have just digitised and click **OK** in the **Map Frame** dialog box.

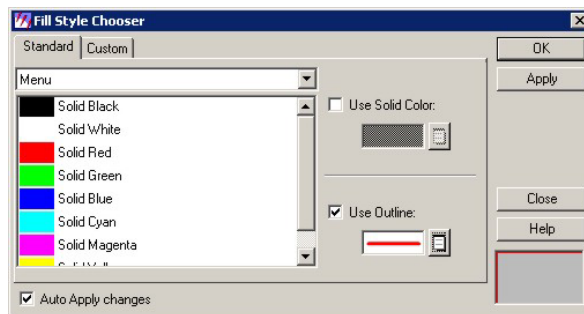


The shapefile will be added to the map composition

28. We now want to draw a red box around the airphoto mosaic actually in the map composer, to illustrate the link between the areas.
29. Click the **Annotation Styles** button and then from the **Styles** dialog box click **Fill Style** button



30. From the **Fill Style Chooser** dialog box toggle off the **Use Solid Colour** dialog box and change the **Use Outline** to red 2.5pts. Click **OK**

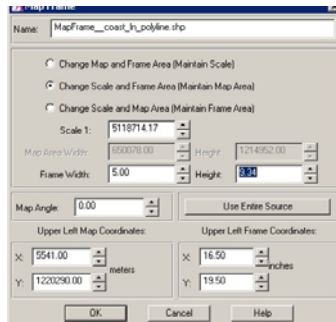



31. Zoom into the air photo mosaic in the map composition. From the **Annotation** palette select the **Create Rectangle Annotation** button.

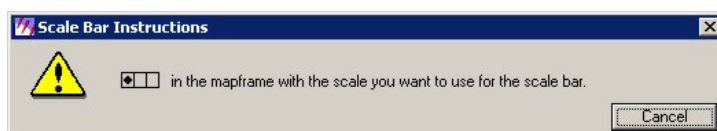


Create rectangle annotation

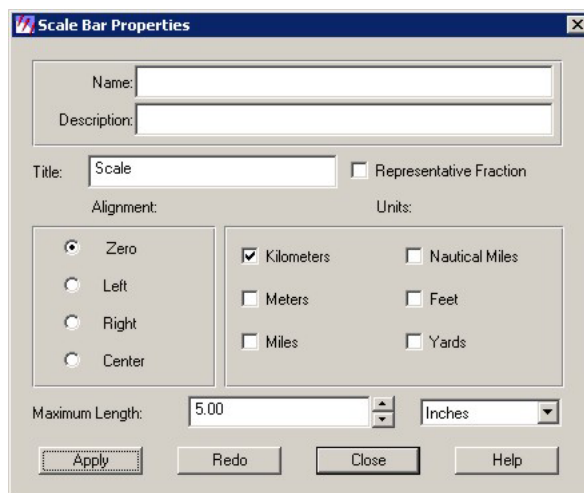
32. Draw a box around the air photo mosaic, by clicking and dragging with the left mouse button.
33. In a new Viewer navigate to *E:\ERDAS_Training\Examples\map_composer* and open *coast_in_polyline.shp*. This is an OS Meridian outline of the UK coastline.
34. In the same way as the other images insert the shape file into the map composition. Ensure the Change Scale and Frame Area option is toggled and the entire source is being used. Specify a frame width of 5.00 and a height of 9.34 and the upper left frame coordinates should be set at X=16.50 and Y=19.50.



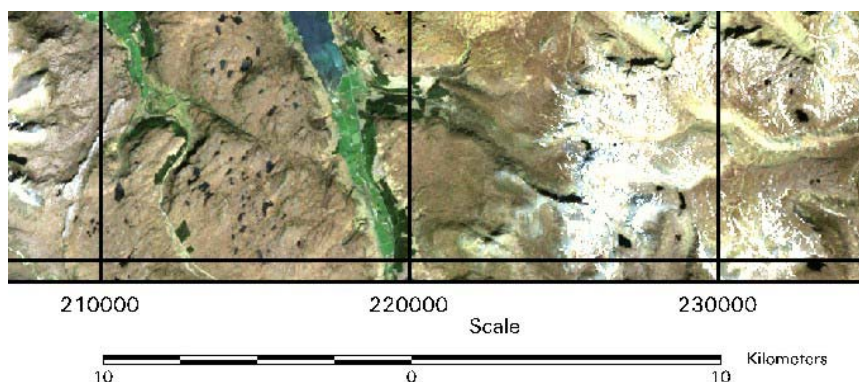
35. With the fill style set to a blue outline, create a rectangle annotation, illustrating the approximate position of the area of the satellite image on the vector coast shapefile.
36. We will now add scale bars to the images. Imagine calculates the scale automatically. From the **Annotation** toolbar palette, click the **Create Scale Bar** button .
37. Click once directly below the satellite image. This is where the scale bar will be placed.
38. Follow the instructions and click once in the map frame of the satellite image



39. When the **Scale Bar Properties Menu** appears, Specify the Units as **Kilometres** and the **Maximum Length** as 5 inches. Then click **Apply** and **Close**




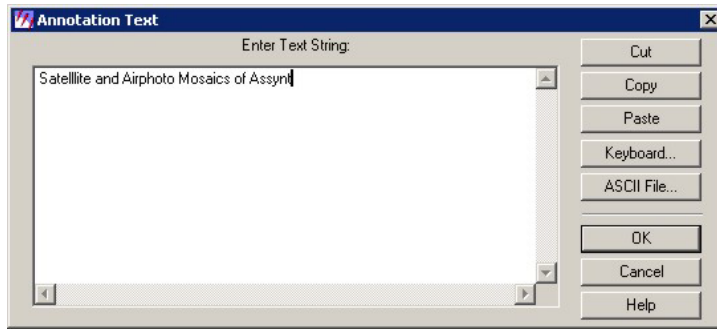
40. Position the tool bar, so it lines up with the grid as shown below. This can be done in the same way as you would move text. Be careful not to resize as this invalidates the scale.



41. Add the following text below the scale bar in an appropriate size
- 1:200000
42. Repeat the process for the air photo mosaic, again specifying a minimum size of 5 inches, and the following text:
- 1:125000

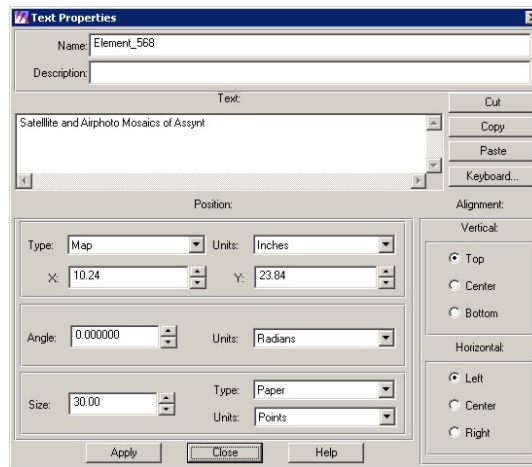
Useful tip: If you make a mistake and want to delete the scale bar, the best way to do this is to make it active and then use the **Cut** button from the **Annotation** palette. This also works for other annotation such as text, polygons and lines.

43. We will now add titles and text to the composition. Select the **Create Text Annotation** button  from the **Annotation** toolbar, and click with the left mouse button at the top of the map composition
44. Type in 'Satellite and Airphoto Mosaic of Assynt' and click **OK**



45. You will notice that the text appears very small. Double click on the text with the left mouse button. This opens the **Text Properties** dialog box. Here you can change various properties of the text such as positioning and size.

Increase the size to 30 and click **OK**



46. It is also possible to manually move the text and change its size. To do this the text need to be made active. Click once with the left mouse button.

- To reposition click towards the centre of the text and drag, or use the directional keypad.
- To resize click and drag one of the corner points.

Experiment with both of these until the text has a size and position you like.

47. Also add the following text to the map composition:

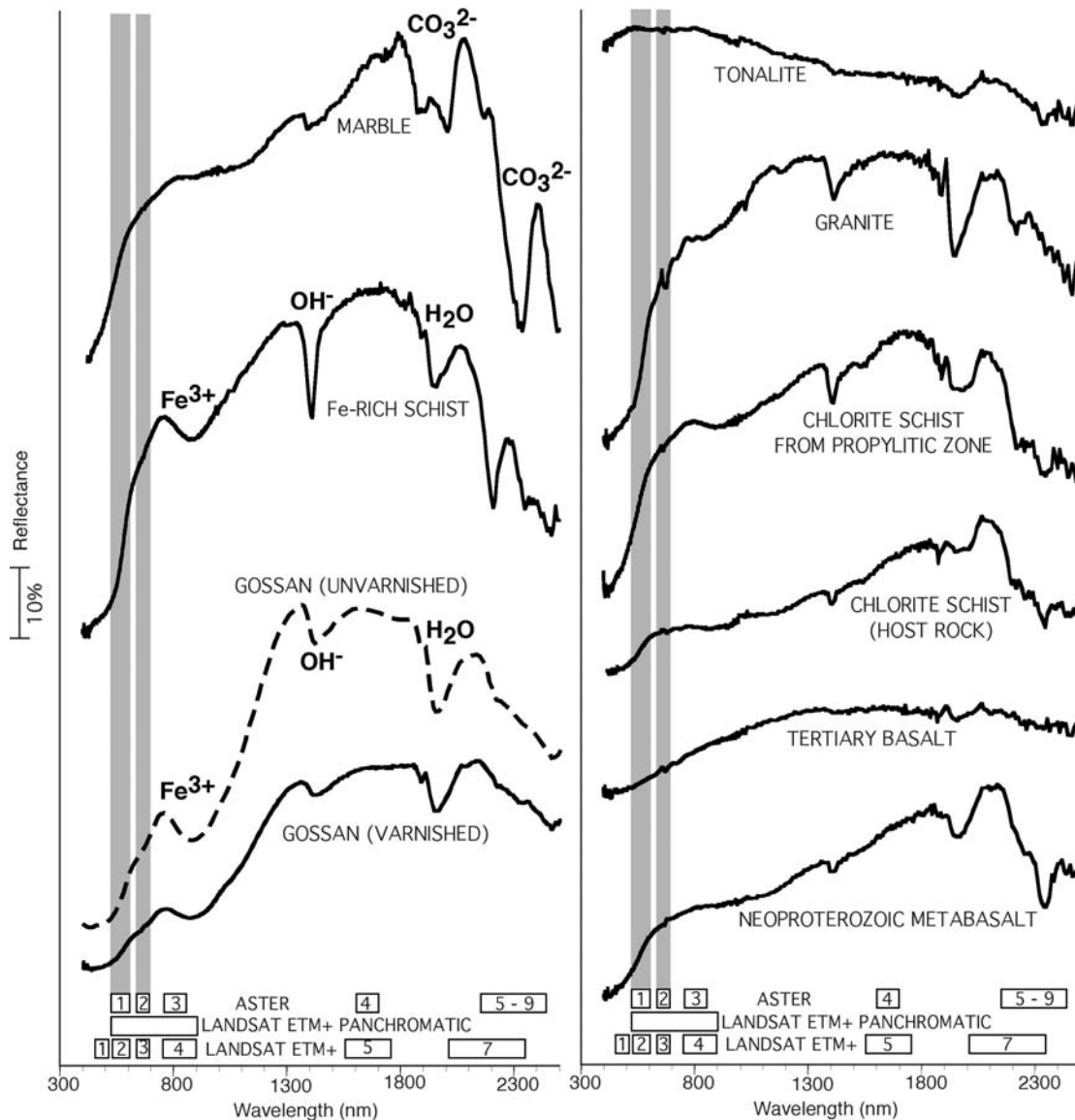
- Under the satellite image: Landsat 7 ETM mosaic of Assynt
- Under the airphoto mosiac: 1:25000 air photo mosaic
- Under the coastline image: Copyright Ordnance Survey

You may need to reposition the scale bars slightly.

8 Module 10 - Band Ratios

Band ratioing is the process of dividing one band by another. This process will highlight a certain feature of the surface depending on its spectra in certain bands.

The first step is to decide which features are to be highlighted. For Remote Sensing Geology we are often concerned with mineral exploration. Different minerals absorb and reflect different regions of the Electromagnetic Spectrum. Using devices such as the PIMA (Portable Infrared mineral Spectrometer) we can measure the spectra of a mineral sample to produce a graph such as that below.



If we take the example of the Fe-Rich Schist above, we can see, that it has a high reflectance value for band 3 of Landsat and a low reflectance for band 1. Therefore a ratio of bands 3/1 will distinguish the Iron Oxide minerals.


Other important band ratios are:

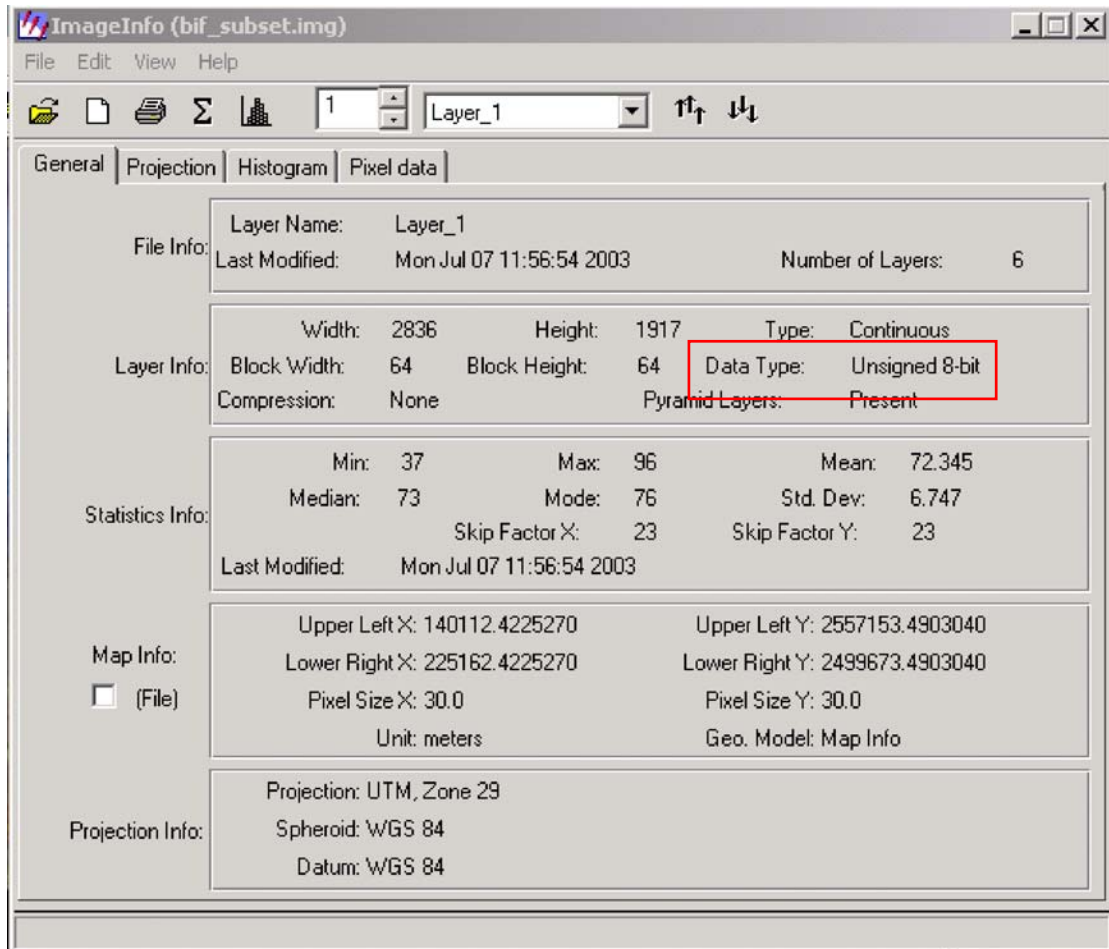
- Landsat bands 5/4 for Ferrous minerals
- Landsat bands 5/7 for clay minerals.

It also possible to define your own band ratios for different minerals using spectra such as the ones seen above.

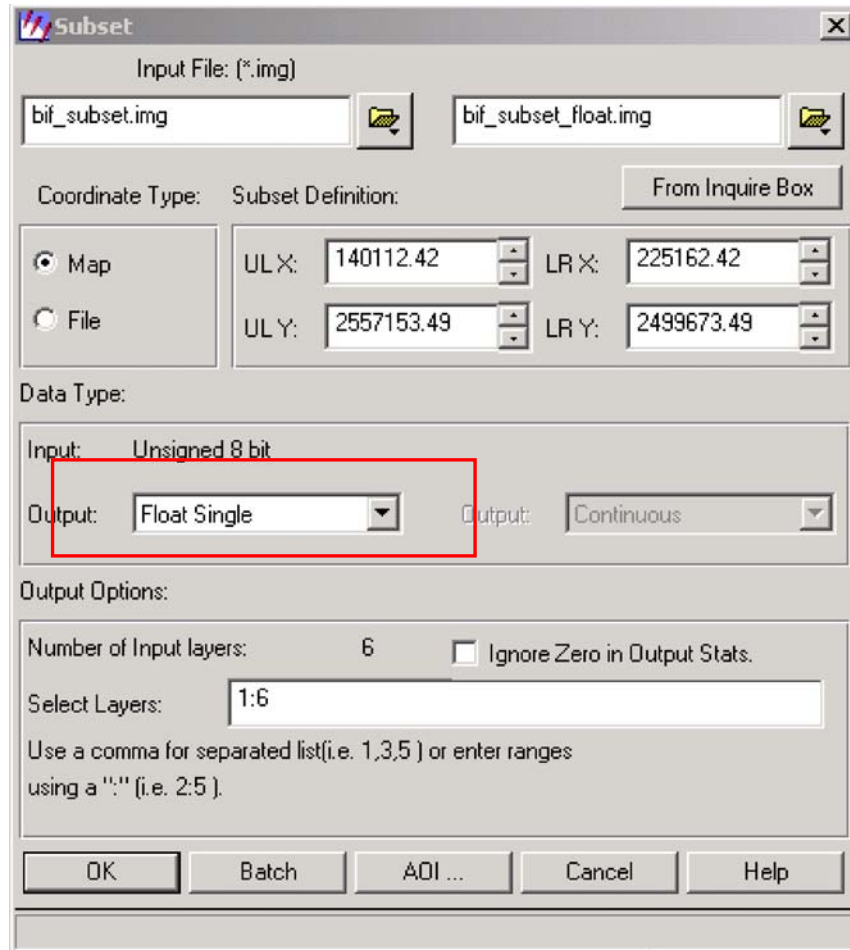
Important note.

For band ratioing in ERDAS IMAGINE it is imperative that the data to be ratioed are in a floating data format (as standard Imagine images are in an unsigned 8-bit format). The first step to band ratioing is therefore to alter the data type.

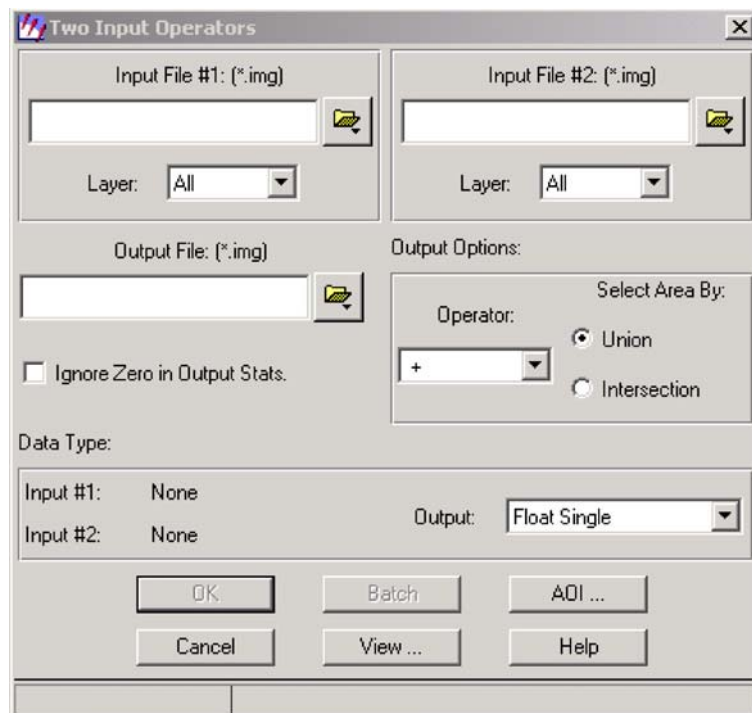
1. Open a viewer and use the image information icon  to open the image information for the file *bif_subset.img* (this is an extract from a Landsat ETM scene in Northern Mauritania) check if the data are in a 'float' format:



2. If as above, the data are not floating point then it is necessary to use the subset image process to alter the data type. If the data is already float then you can skip to point 7.
3. Open the subset image process dialogue (**DataPrep – Subset Image**).
4. For the input image enter the image which you wish to use for the ratio.
5. For the output enter a file name.
6. It is only necessary to alter the output data type to 'float single'; all the other options in the dialogue can remain as the default.

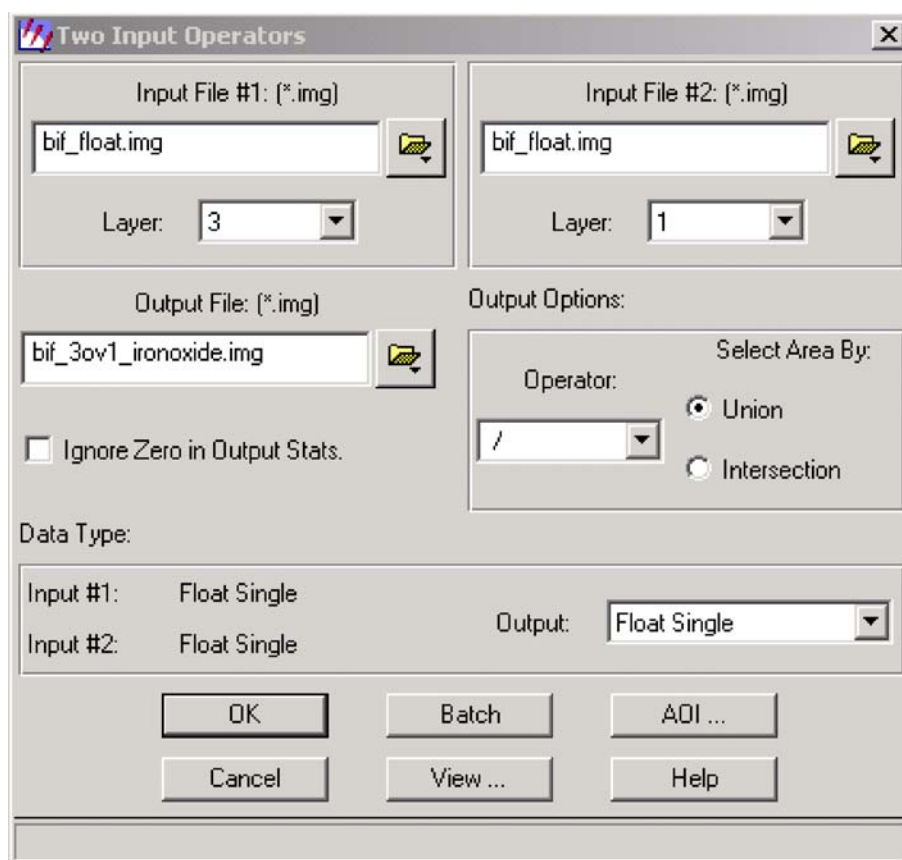


- Once the data are floating point, you can start the band rationing process. In Imagine it is possible to ratio bands from within the same image. From the main Imagine menu select the interpreter button, then utilities then operators. A dialogue as below will open:



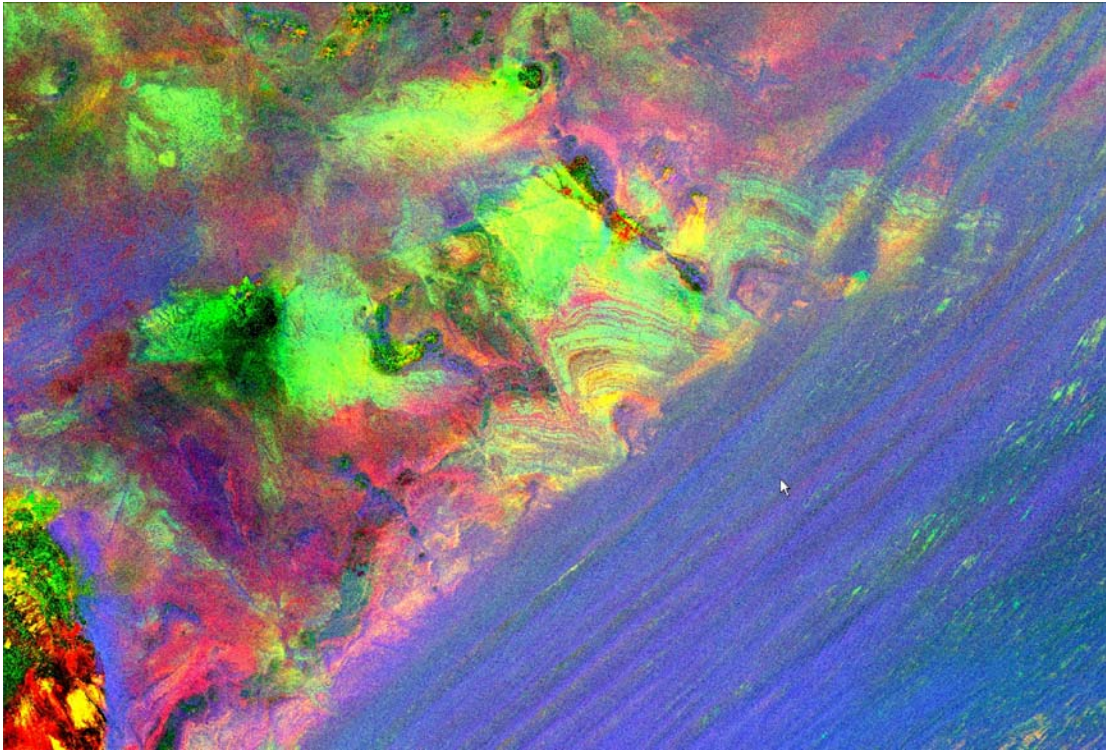
- This dialogue allows mathematical operations to be carried out between different images or between different bands of the same image.

9. The input file number 1 and number 2 will both be the same floating data file created in step 6. However we need to specify the band (layer) for each image. For this exercise we will first carry out a ratio to reveal Iron Oxide. For input file 1 use the drop down menu below to specify band 3. For input file 2, specify band 1. We are therefore dividing band 3 by band 1.



10. In the output options use the dropdown menu to specify “/” (division) as the operator.
11. Enter a name for the output image and ensure that it is a floating data type. Click OK and the process will run. This will produce a single band image, which will be displayed as a greyscale image. In order to add colour to the image we need to specify two additional band ratios and then use the layer stack command to produce a 3-band image.
12. Carry out steps 7 to 11 for the same image, however now we want to produce a 5/7 (clay minerals) and a 5/4 (ferrous mineral) ratio.
13. Once all three images have been processed, use the interpreter – Layer Stack operation to stack the three images in the following order:
- Input 1 = 5/4 Ferrous
 - Input 2 = 5/7 Clay
 - Input 3 = 3/1 Iron Oxide

This will produce a three-band image in which all the ferrous minerals will appear as shades of red, the clay minerals as greens and the Iron Oxide minerals as blues, such as below:



Note: the ratios and mineral composite images described above can be made using the **Indices** option in Imagine version 8.6 and above. The process is available via **Image Interpreter** and **Spectral Enhancement**.

Appendix 1

IMPORT/EXPORT FORMATS

These file types may be read and written directly by IMAGINE

(From ERDAS IMAGINE On-Line Help Copyright (c) 1982-1999 ERDAS, Inc)

Extension	Format	Description
.aoi	HFA	Area of Interest file - stores a user-defined area of interest.
.bil	Binary	ESRI Arc/Info & Space Imaging BIL raster file.
.bip	Binary	ESRI Arc/Info & Space Imaging BIP raster file.
.bsq	Binary	ESRI Arc/Info & Space Imaging BSQ raster file.
.bmp		Windows bitmap
.dt1	Binary	DTED Level 1 & 2
.ers	Binary	ERMapper format image file.
.fit	Binary	Silicon Graphics image file format
.gif	Binary	GIF format static image files, usually downloaded from Web sites. The optional LZW Module is required to read these files as GIF is based on the LZW compression technique patented by Unisys.
.gis	ERDAS 7.x	Thematic file - raster data
.glt		Geospatial Light Table session file
.img	HFA	Image file - stores single or multiple raster layers, contrast and color tables, descriptor tables, pyramid layers, and file information.
.jpg	Binary	JPEG File Interchange Format (JFIF) image files.
.lan	ERDAS 7.x	Continuous file -raster data
.map	ASCII	Map file - stores map frames created with Map Composer.
.ovr	HFA	Overlay file - stores an annotation layer which was created in a map frame, in a blank Viewer, or on an image in a Viewer.
.png		Portable Network Graphic
.pro	Binary	Plus3 TerraModel project layers - vector engineering drawings.
.raw	ASCII	Header file used to describe the formatting of generic binary data files to allow them to be used by the Raw format Raster DLL. Thus, most raster data in BIL, BIP or BSQ file format can be accessed directly merely by defining this simple header.

.sdv		SDE Vector Layer
.shp		ESRI ShapeFile
.sid		MrSiD® Compressor
.stk	ASCII	ESRI GRID Stack file
.tif	Binary	Tagged Image File Format (TIFF) file, including GeoTIFF raster file
.trl		Snail Trail from Geospatial Light Table
.vue	ASCII	Viewer View file - defines the configuration of a Viewer. These files are used to store and recall the exact size, position, and content of a Viewer of map composition.

File types that may be imported or exported through the IMAGINE Import/Export facilities

(From ERDAS IMAGINE On-Line Help Copyright (c) 1982-1999 ERDAS, Inc)

Import (If you are importing data into IMAGINE)

ADRG	Select this option to import ARC Digitized Raster Graphics data from CD-ROM only.
ADRI	Select this option to import ARC Digitized Raster Images data from tape only.
ANT (ERDAS 7.x)	Select this option to import annotation ERDAS Ver. 7.5 and earlier data from file or CD-ROM.
ARCGEN	This option applicable to the Vector module only. Select this option to import ARC/INFO GENERATE format files from file or CD-ROM. The
Arc_Interchange to Coverage	This option applicable to the Vector module only. Select this option to import data in ARC Interchange format file or CD-ROM.
Arc_Interchange to Grid	This option applicable to the Vector module only. Select this option to import data in ARC Interchange format file or CD-ROM.
ASCII Raster	Select this option to import data in ASCII format from file or CD-ROM.
ASCII To Point Coverage	Select this option to import data in ASCII format from file or CD-ROM to a point coverage of single or double precision
ASCII To Point Annotation	Select this option to import data in ASCII format from file or CD-ROM to point annotation.
AVHRR (NOAA)	Select this option to import NOAA Advanced Very High Resolution Radiometer data from tape, file, or CD-ROM.
AVHRR (Dundee Format)	Select this option to import Advanced Very High Resolution Radiometer data in Dundee format from tape.
AVHRR (Sharp)	Select this option to import Advanced Very High Resolution Radiometer data in Dundee format from tape.
CADRG (Compressed ADRG)	Select this option to import RPF frames that are distributed by the Defense Mapping Agency (DMA).
CIB (Controlled Image Base)	Select this option to import RPF frames that are distributed by the Defense Mapping Agency (DMA).
DAEDALUS	Select this option to load Daedalus AMS and ABS sensor data from 8mm tapes.
USGS DEM	Select this option to import U.S.G.S. Digital Elevation Models from tape, file, or CD-ROM.
DFAD	This option applicable to the Vector module only. Select this option to import Defense Mapping Agency DFAD vector data from file or CD-ROM.
DGN (Intergraph IGDS)	Select this option to import an Interactive Graphics Design Software (IGDS) file (also called Intergraph Design File, or DGN file) into an Arc/Info coverage.
DIG (ERDAS 7.x)	Select this option to import ERDAS Ver. 7.X DIG data from file or CD-ROM.
DLG	This option applicable to the Vector module only. Select this option to import U.S.G.S Digital Line Graphs (vector) from file or CD-ROM.
DOQ	Select this option to import Digital Ortho Quad (DOQ) data from tape, file, or CD-ROM.
DOQ(JPEG)	Select this option to import JPEG-Compressed DOQ's from tape, file, or CD-ROM.
DTED	Select this option to import Digital Terrain Elevation Data from tape, file, or CD-ROM.
DXF To Coverage	Select this option to import AutoCAD Digital Exchange Files (vector) from file or CD-ROM.
DXF To Annotation	Select this option to import AutoCAD Digital Exchange Files (vector) from file or CD-ROM into IMAGINE annotation file format.
ERS	Select this option to import CEOS (Committee for Earth Observation Standards) images in the format established by the European Space Agency (ERS).
ETAK	This option applicable to the Vector module only. Select this option to import MapBase digital street network files (vector) from file or CD-ROM.
Generic Binary	This option lets you import binary data types from tape, file, or CD-ROM that are not listed here, by defining the data format for IMAGINE.
GeoTIFF	Select this option to import TIFF data (Tagged Image File Format) from file or CD-ROM.
GIS (ERDAS 7.x)	Select this option to import ERDAS Ver. 7.X GIS data from file or CD-ROM.
GRASS	Select this option to import GRASS data (raster) from file only.
GRD	Select this option to import Surfer Grid data.
GRID	This option available on UNIX and NT platforms only. Select this option to import GRID raster data (complement to ARC/INFO - distributed by ESRI) from file or CD-ROM.
IGDS (Intergraph .dgn File)	Select this option to import an Interactive Graphics Design Software (IGDS) file (also called Intergraph Design File, or DGN file) into an Arc/Info coverage.
IGES	This option applicable to the Vector module only. Select this option to import U.S. Department of Commerce Initial Graphics Exchange Standard files (vector) from file or CD-ROM.

IRS-1C	Select this option to import an IRS-1C file from file, CD-ROM, or tape into ERDAS IMAGINE format. The supported data is distributed by EOSAT or EUROMAP.
JFIF (JPEG)	Select this option to import a JFIF (JPEG File Interchange Format) file from file, CD-ROM, or tape into ERDAS IMAGINE format.
MIF/MID	Select this option to import MapInfo data to a ARC/INFO coverage.
MSS Landsat	Select this option to import Landsat MSS data from tape only.
NLAPS	Select this option to import NLAPS (National Landsat Archive Production System) data or NLAPS Data Format (NDF) data from file, tape, or CD-ROM.
PCX	Select this option to import PCX line art data from file or CD-ROM.
RADARSAT	Select this option to import CEOS (Committee for Earth Observation Standards) Image Products in the format established by RADARSAT, Incorporated (RSI).
Raster Product Format	Select this option to import RPF frames that are distributed by the Defense Mapping Agency (DMA).
SDTS Vector	Select this option to import SDTS Topological Vector Profile (TVP) transfer files to vector coverage(s).
SDTS Raster	Select this option to import SDTS (Spatial Data Transfer Standard) images that conform to the Raster Profile.
SeaWiFS	Select this option to import SeaWiFS (Sea Wide Field of View Sensor) data in the format produced by Orbital Sciences Corporation.
Shapefile	Select this option to import a Shape file to a coverage.
SPOT	Select this option to import SPOT satellite data from CD-ROM, tape, or file.
SPOT (GeoSpot)	Select this option to import Geospot satellite data from CD-ROM, tape, or file.
Sun Raster	Select this option to import a Sun Raster file from file or CD-ROM.
TIFF	Select this option to import TIFF data (Tagged Image File Format) from file or CD-ROM.
TIGER	This option applicable to the Vector module only. Select this option to import U.S. Census Bureau Topologically Integrated Geographic Encoding and Referencing System files (vector) from file or CD-ROM. The Import TIGER dialog is opened.

The following sections open the Landsat TM dialog:

TM Landsat ACRES Fast Format
 TM Landsat ACRES Standard Format
 TM Landsat EOSAT Fast Format
 TM Landsat EOSAT Standard Format
 TM Landsat ESA Fast Format
 TM Landsat ESA Standard Format
 TM Landsat IRS Fast Format
 TM Landsat IRS Standard Format
 TM Landsat RADARSAT Fast Format
 TM Landsat RADARSAT Standard Format

The following selections open the Import Landsat-7 Fast L7A dialog:

Landsat-7 Fast L7A EROS
 Landsat-7 Fast L7A ACRES
 LAN (ERDAS 7.x) Select this option to import ERDAS Ver. 7.X LAN data from file or CD-ROM.

Export (If you are exporting an ERDAS IMAGINE file into another format)

ARCGEN	This option applicable to the Vector module only.
Coverage to Arc_Interchange	This option applicable to the Vector module only.
Grid to Arc_Interchange	This option applicable to the Vector module only.
MIF	Select this option to export ARC/INFO coverage to MapInfo data.
USGS DEM	Select this option to export an .img file into the USGS Digital Elevation Model (DEM) format.
DFAD	This option applicable to the Vector module only. Click to export ERDAS IMAGINE vector layers to the DFAD (file only).
DGN (Intergraph IGDS)	Select this option to export an Arc/Info coverage to an Interactive Graphics Design Software file (IGDS file, also known as Intergraph Design file, or DGN file).
DLG	This option applicable to the Vector module only. Click to export ERDAS IMAGINE vector files as U.S.G.S Digital Line Graphs (file only).
DOQ	Click to export .img files to Digital Ortho Quads (file only).
Coverage to DXF	Click to export ERDAS IMAGINE vector coverages, to file only, as AutoCAD Digital Exchange Files (vector).
GeoTIFF	Click to export .img files as TIFF (Tagged Image File Format) data.
Generic Binary	This option lets you export binary data types, that are not listed here, to tape or file, by defining the data format for IMAGINE.
GIS (ERDAS 7.x)	Click to export .img files as ERDAS Ver. 7.X GIS files (file only).
GRASS	Click to export .img files as GRASS data to file only. The Export GRASS Data dialog is opened.
GRD	Select this option to export files from IMAGINE to Surfer Grid files.
GRID	This option available on UNIX and NT platforms only.
IGDS (Intergraph .dgn File)	Select this option to export an Arc/Info coverage to an Interactive Graphics Design Software file (IGDS file, also known as Intergraph Design file, or DGN file).
IGES	This option applicable to the Vector module only.
JFIF (JPEG)	Click to export an ERDAS IMAGINE .img file into JFIF (JPEG File Interchange Format) format (file only).
LAN (ERDAS 7.x)	Click to export .img files as ERDAS Ver. 7.X LAN files (to file only).
Annotation To DXF	Click to export an IMAGINE annotation file into AutoCAD Digital Exchange Files (vector) format (to file only).
PCX	Click to export .img files as PCX line art files (file only).
SDTS Vector	Select this option to export vector coverages to SDTS Topological Vector Profile (TVP) transfer files.
SDTS Raster	Select this option to export an .img file to an SDTS Raster Profile transfer.
Shapefile	Select this option to export a vector coverage to a shape file.
TIFF	Click to export .img files as TIFF (Tagged Image File Format) data.

TIGER

This option applicable to the Vector module only. Click to export ERDAS IMAGINE vector coverages as U.S. Census Bureau Topologically Integrated Geographic Encoding and Referencing System files (vector)(file only).

VPF

This option applicable to the Vector module only. Click to export ERDAS IMAGINE vector layers to ESRI's VPF coverages (file only).