Exercise #6

Digital Elevation Models and Image Drape

- **To locate and download DEM files from the Internet.**
- **To format and read DEM files in Imagine.**
- **To view topography using a DEM.**
- **To locate and download DOQQ files from the Internet.**
- **To import DOQ files into Imagine.**
- **To drape a DOQ file (aerial photo) over topography for viewing/fly-thru's in Imagine**

Introduction to Digital Elevation Models

A Digital Elevation Model (DEM) is a digital representation of a the elevations of a portion of the Earth's surface, or any planet's surface at regularly spaced horizontal intervals. It is simply a digital recording of the contours of the terrain (z-values) on a grid.

DEMs come in an array of sizes. For example, the United States Geological Survey (USGS) produces several different digital elevation models. The principal difference between them is the sampling interval and area covered. A smaller interval will yield higher surface resolution because more elevation measurements are made in a given area. The most detailed and therefore, highest resolution, DEM currently available free of charge is the 10 meter USGS 7.5 minute SDTS DEM.

Spatial Data Transfer Standard (SDTS) Format

The Spatial Data Transfer Standard distribution format is designed as a mechanism for the transfer of spatial data between various computer systems. The SDTS format is

designed to transfer with complete content transfer (no loss of information). DEM files in this format can be imported into Imagine using the "Import" utility and saved as an Imagine (.img) file.

Orthophotos

Orthophotos (or orthorectified photos) are derived from aerial photographs which have been corrected so that they appear as if every point in the image was viewed from directly overhead. Since the camera can only be overhead at a single point in the original image (the principal point), the other points in the image were photographed at an angle (normally very close to perpendicular, but not exactly) so that some part of the sides of buildings etc. can be seen. In true orthophotos these sides would not be seen because the photo would display each building as if it were directly below the camera at every point. In the original image, locations which are at a different altitude or elevation from the principal point will be radially displaced from their true planimetric (x, y) position. If they are higher in elevation they will be displaced radially outwards from their correct position and if they are lower they will be displaced radially inwards. So that for any region with varying topography the (x, y) coordinates of points in the image will be displaced from their true position. An **orthophoto** corrects for the topography by shifting points in the image according to their radial displacement, which is calculated from topographical (DEM) data (and the known altitude of the camera).

Orthophotos can be draped over elevation models of the terrain to create life-like representations of the landscape. This technique is used to generate fly-throughs used in simulations and movies. You will apply this technique using the Imagine software. The draping of the image over the terrain depicts the area as it would look to you from an aircraft.

Image Drape

The files you need to perform an image drape are a DEM file and an orthophoto (DOQ file). Samples of these have been downloaded for you for the Burbank area.

1. Open Imagine and import the Burbank DEM file from the Burbank_DEM folder by selecting "IMPORT". For Type, select DEM (SDTS) and for Media select File. The INPUT file is 9953iden.ddf. For the OUTPUT file, the computer will assign a default name to the file, but you should navigate yourself to make sure it goes into the correct folder. Be sure to save the file to your subdirectory and click OK to import it.

Before processing begins, an IMPORT SDTS RASTER PROFILE window appears depicting relevant information about the DEM.

Open the DEM Imagine file in the viewer. You may find that the image is completely white! This is because of the contrast and the range of pixel file values. Go to Raster -> Data Scaling and you will see that the minimum value in the file is -32766. The reason for this is that this corresponds to the "fill" value used in the file to denote the absence of data. The problem is that it means that all the brightness levels from 0 to 254 are essentially used to map pixel values from -32766 up to 0, and that only brightness 255 is left for data greater than 0! You will obviously need to change the display information so that more brightness values are used to display the real (positive) data. You can do this in the Data Scaling menu by changing the minimum value to 0 (or greater). You should then see a more useful elevation map of the area. To obtain more contrast, use the info button in the Viewer bar to look at the range of pixel values and select new limits in the Data Scaling or Contrast Stretch menu.

2. Open the photo as a layer on top of the DEM by opening the raster layer o34118b3nw.img from the Burbank_TIF folder in the same Viewer. (Make sure the option to "Clear Display" is not set or the DEM will just be replaced by the photo.) Note that the photo only occupies the NW quarter of the DEM (hence the USGS file name ends in "nw". The USGS quad name is o34118b3 for latitude 34 °N and longitude 118 °W.)

3. Drape the image over the DEM by selecting Utility -> Image Drape. Note the "Eye" and the "Target" in the viewer. You can use the mouse to move these and watch the 3D drape view change accordingly. You can also change your viewing position by selecting Position -> Current Position in the Image Drape viewer and changing the viewing, aircraft and camera parameters. Use the Help from here to obtain a list of the parameters and their meaning.

Turn in a screen dump showing your image drape of the Burbank area.

Next you will download your own DEM and DOQ file for an area of your choice and perform an image drape.

Downloading Digital Elevation Models (DEMs)

First you should create a subdirectory called "DEM" (or some similar name) in your own folder. It is a good idea to place your DEM data into a designated subdirectory because many files are transferred when you perform a download and it is useful to

keep them all together. (Make sure the DEM subdirectory is placed within your own directory on the local drive.)

Next, start Internet Explorer (or Netscape) and go to the GeoCommunity web site at http://data.geocomm.com/dem/. Scroll down to GeoCommunity DEM Resources and click the option "DOWNLOAD DEM DATA HERE". Click on a State (CA) to access DEM data for that State. Below United States—>State of your choice—>Countywide Data, click the County of interest to you. Click "Digital Elevation Models (DEM) – 24K". The Download Option Info is "NORMAL DOWNLOAD". Again, choose an area of interest. (You may want to choose the area that corresponds to your Landsat Los Angeles subset.) In the DOWNLOAD DATA window, you may have a choice between a 30 meter DEM and 10 meter DEM. Your choice will depend on the level of detail you want, but in general you should choose the highest resolution unless you are trying to map a huge area that requires many DEMs. Click a link and save the file to the subdirectory that you created.

You should now have a zipped (compressed) file in your DEM subdirectory. It can be unzipped using the software called WinZip, which should automatically load if you right-click on the file. Choose the option "Extract to here" and the unzipped version will be placed in your DEM subdirectory. If you are prompted for a file extension, enter TAR. Now, you should have two zip files in your DEM subdirectory. Extract (extract to here) the newly-created (tar) zip file to your DEM subdirectory. (Although the original .gz file was unzipped, the file is still in a condensed, .tar, format.) After extraction, you will see many files in the DEM subdirectory.

Now open ERDAS Imagine and select "IMPORT". For Type, select DEM (SDTS) and for Media select File. The INPUT file is _ _ _ _**iden.ddf**. You will find this file in your DEM subdirectory. For the OUTPUT file, the computer will assign a default name to the file, but you should navigate yourself to make sure it goes into the correct folder. Be sure to save the file to your DEM subdirectory and click OK to import it. Before processing begins, an IMPORT SDTS RASTER PROFILE window appears depicting relevant information about the DEM.

Downloading Digital Ortho Quads (DOQs)

Next, start Internet Explorer (or Netscape) and go to the GeoCommunity web site at http://data.geocomm.com/doqq/. Scroll down to GeoCommunity DEM Resources and click the option "DOWNLOAD DOQQ DATA HERE". Click on a State (CA) to access DOQQ data for that State. Below United States—>State of your choice—>Countywide Data, click the County of interest to you. Click "Digital Orthophotos (DOQ/DOQQ) - 1 Meter". You may find only Premium Downloads are available – in

which case there is a small fee (a couple of dollars perhaps) for the download. If this is the case you may want to go to a CASIL (California Spatial Information Library) site instead, where the data is generally free. I use a casil mirror site at: http://casil-mirror1.ceres.ca.gov/casil/usgs.gov/doqq/. From here you can click on the maps to select the area you want and then click on the files to download. You should download all four files for the quarter quad (QQ) that you desire. These include a .tif file (the photo), a .tfw file ("world" file with projection information), and .tif.xml and .txt files (metadata).

Now open ERDAS Imagine and select "IMPORT". For Type, select GeoTiff and for Media select File. The INPUT file is the .tif file. For the OUTPUT file, the computer will assign a default name to the file, but you should navigate through the folders to make sure it goes into the correct location.

Image Drape

Now drape your photo over your DEM using the Image Drape utility to get a 3D perspective view of the area. Adjust the viewing parameters using the Position menu. **Turn in a screen dump showing your DEM/DOQ Viewer and your 3D drape view.**

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