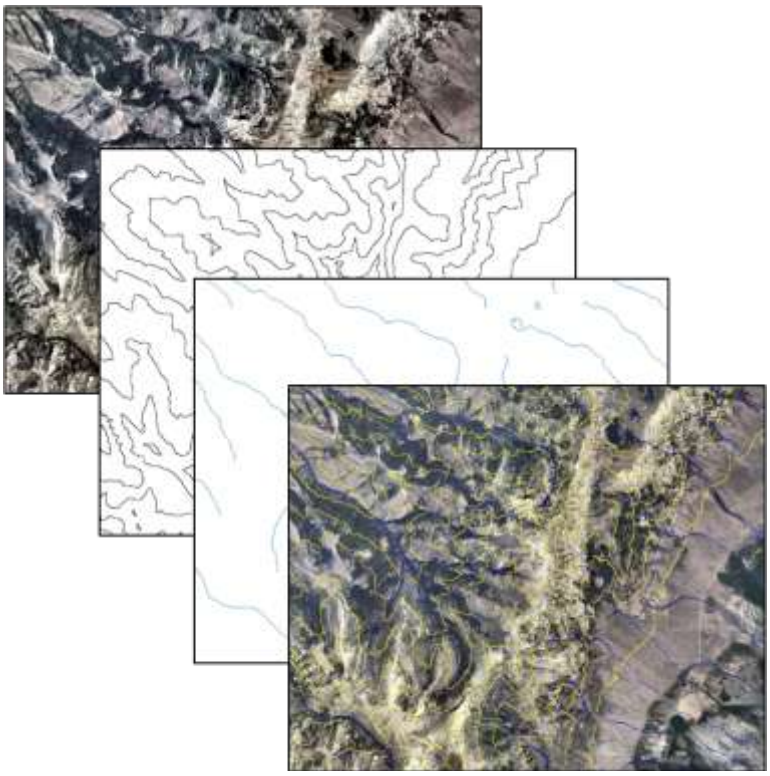
PREPARING IMAGE BASE MAPS FOR THE DIGITAL AERIAL SKETCHMAPPING (DASM) SYSTEM



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This document is a step-by-step outline of how to make image base maps for the Digital Aerial Sketchmapping (DASM) system. Image maps can be made using many different image sources, but the most popular has been aerial imagery produced by the National Agricultural Imagery Program(NAIP). This aerial imagery is continuous across CONUS and is collected at regular (usually 3-year) intervals.

While the imagery provides detailed land cover information, surveyors have found that additional reference information is helpful in geolocating features. Contour lines and/or hydrography (streams) especially help in areas where the land cover is homogenous. Because of their large size, shapefiles of these features cannot be efficiently displayed in GeoLink software. To address this issue, we have developed methods to integrate the vector data into the raster imagery by 'burning' in the vectors - changing the raster image pixels that are coincident with the vectors. In this document we will outline the steps to making 15m resolution, 30x60 USGS quad maps with contour and stream vectors burned into NAIP imagery. If you wish to make NAIP image maps without any vectors burned in, the process is much simpler and is described in Appendix C.

Since most surveyors update maps for their entire survey area, our methods will focus on how to batch these processes. In order to do that, we need to establish a 'region'. A region will be the geographical area where you want to make maps. This can be a NFS Region, a State or group of smaller states, or a block of 30x60 quads. We will use the state of Nevada as an example in this demo.

This demo was conducted using ESRI ArcMap 10 and ERDAS Imagine 2010 software. Basic knowledge of these software packages is assumed. Unless otherwise stated, use the defaults assigned to parameters by the software. A batch command file (.bcf) and a model file (.mdl) should accompany this manual; the text of these files is included in Appendices A and B.

We will need three datasets that cover our region to make the maps:

1. A vector dataset (shapefile) of streams (hydro)
2. A 30m (or better) digital terrain model (DTM) or digital elevation model (DEM).
3. NAIP image files.

The following sections describe how to gather and process these three datasets:

1. Hydrography Files

a. Download hydro shapefiles

One data source for hydro files is TIGER census data. The data can be downloaded from http://www.esri.com/data/download/census2000_tigerline/index.html
On the left side of the screen, click on Preview and Download. Select the State you want and then select the layer (not the county) desired. This will give you a list of layers. The layer you want is Line Features – Hydrography. Click 'submit selection'. This will produce a list of Counties. For small states there is an option at the top of the list where you can select all counties. For most states you have to check the boxes for the counties you want. There is a limit of 20MB per request, so you can pick quite a few counties. The data are in Goeographic NAD83, but there are no prj files.

b. Process the county shapefiles

Unzip the shapefiles and load them in to ArcMAP. Because the data have no projection information, you will get a message saying that the data can be displayed, but is not projected properly. Click 'Ok'. Check to see that all counties have a hydro shapefile: (Figure 1):

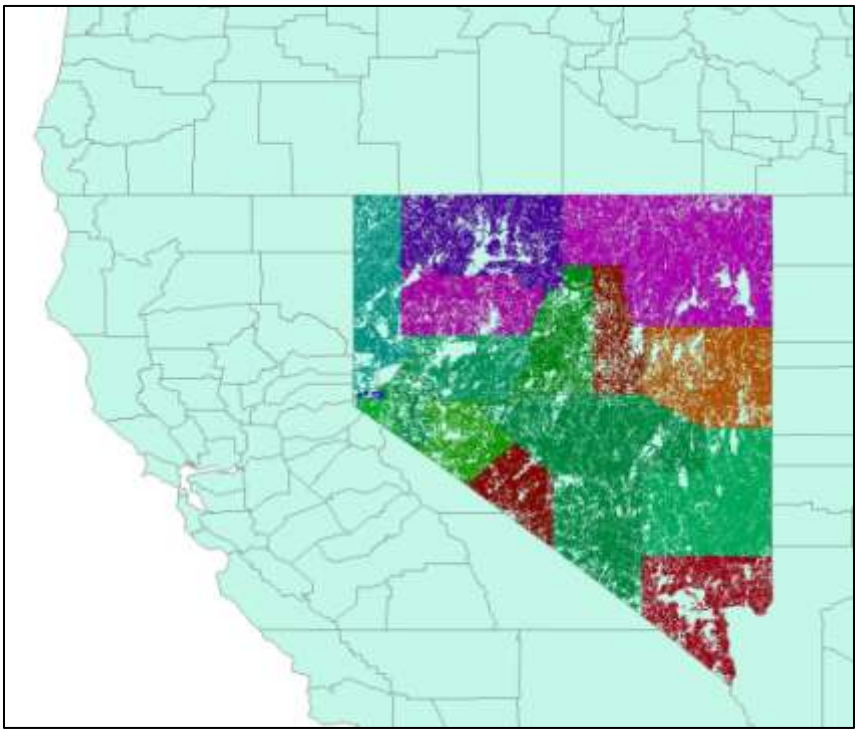

Figure 1. TIGER County Hydrology shapefiles for Nevada.

c. Merge hydro shapefiles

Now, merge the county shapefiles into a single shapefile of hydro vectors for the entire state. Use the ArcMap Merge tool (GeoProcessing → Merge). Next define the projection for this merged dataset using the define projection tool (Data Management → Projections and Transformations -->Feature--> Define Projection. Use the GCS_North_American projection (NAD 1983.prj). Finally, reproject this shapefile to your desired projection. In our example (Nevada) this will be UTM Zone 11 NAD83.

d. Create a raster file from the hydro shapefile

Use the 'Vector to Raster' tool in ERDAS Imagine 2010 to create the raster.
Set the cell size to 15m (Figure 2). The input vector dialog defaults to ArcCoverage; use the pull-down menu to select 'shapefile'.

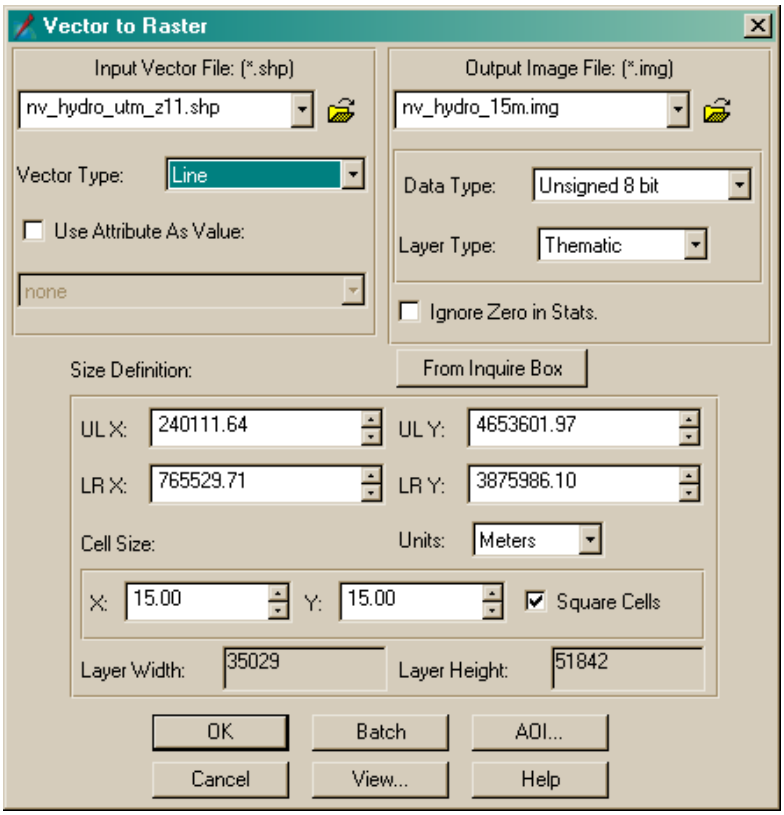

Figure 2. Settings to create a 15m raster file from the hydro shapefile in the ERDAS Imagine 2010 *Vector to Raster* tool.

2. Contour Files

a. Gather elevation data

National Elevation Datasets (NED) data can be downloaded from the USGS site (http://ned.usgs.gov/Ned/faq.asp). but the format is 1x1 degree tiles - many files for large areas. You may have a source locally that is more efficient. What you want are the 1 arc-second (approx 30m) data. An alternative is to use NED tiles available from RSAC (Contact Scott or Charlie). These are ERDAS Imagine (.img) files, are 1 arc-second (approx 30m), 16 bit (elevation values are in meters) and are in Geographic, GRS 1980, NAD83. Using the Tile Index map in Appendix D, we determine that tiles 10, 11, 18 and 19 are needed to cover Nevada.

b. Mosaic NED Tiles

Now we will mosaic the NED tiles using **ERDAS Imagine 2010**. Open the 'Mosaic Pro' tool and add the tiles. Make sure the overlap function is set to 'overlay'. It is tempting to set the new output projection in 'Output Options' but my experience is that you will get memory errors. Output data type should be signed or unsigned 16-bit, depending on if you have any areas below sea-level (In our NV example, the NED tiles encompass Death Valley

so our mosaic is signed 16-bit. The mosaic can also be done with the 'Mosaic to New Raster' tool in ArcMap 10 (ArcToolbox: 'Data Management Tools' → 'Raster' → 'Raster Dataset'. Figure 3 shows how to set up the dialog; be sure to specify 16-bit output.

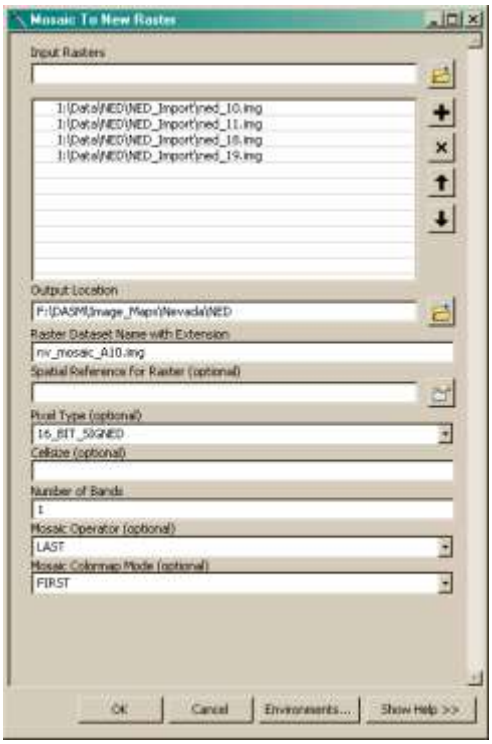

Figure 3. *Mosaic to New Raster* dialog in ArcMap 10.

c. <u>Reproject NED raster file</u>

Next, reproject the NED mosaic to the new projection. For NV, we are using UTM Zone 11 NAD83. Figure 4 shows the 'Project Raster' dialog ('Data Management Tools' → 'Projections and Transformations' → 'Raster' → 'Project Raster'). ***Important: Be sure to select 'Cubic' as the resampling method, and set the output cell size to 15m.***

Figure 4. ArcMap 10 *Project Raster* ArcTool dialog.

d. <u>Create contour features</u>

The next step is to create contour raster files from the reprojected NED file using the Raster Contour tool in ERDAS Imagine 2010 ('Terrain' tab, 'Raster Contour' tool). Specify the contour interval in meters - typically 100 or 200. In our NV example, we will create 200m contours.

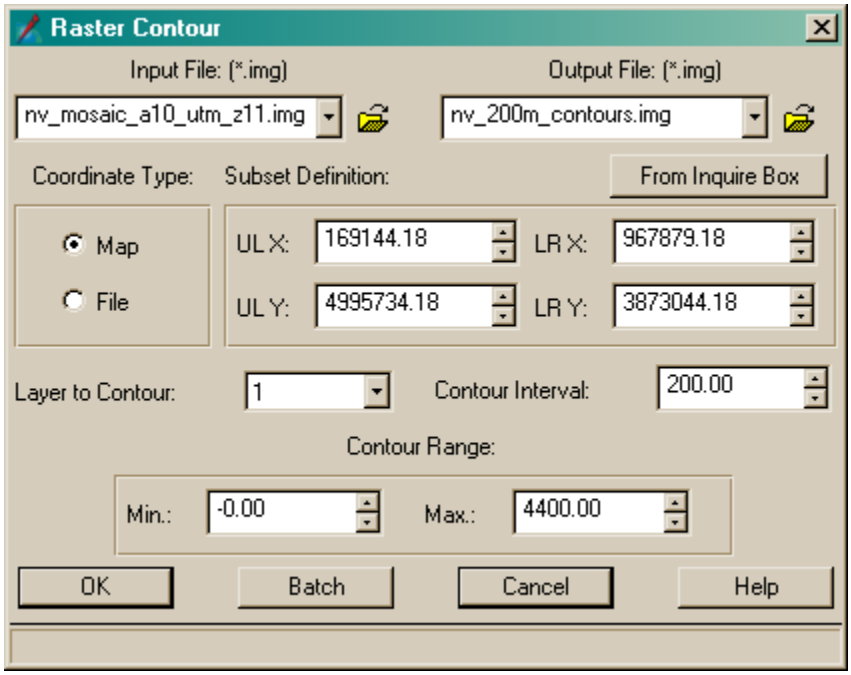

Figure 5. Settings for the *Raster Contour* tool in ERDAS Imagine 2010.

3. NAIP Imagery

The NAIP program contracts with several companies to collect and process image data, this results in some variation in data quality across states. Cooperating states and federal agencies may also request the data in different resolutions and formats. Compressed County Mosiacs (CCM's) are 1 meter, 3-band (R,G,B) or 4-band (R,G,B, IR), MrSID format county files; these are a standard deliverable along with quarter-quad geoTiff files. We have primarily used the CCM products as they typically are color-balanced and the compression makes the files relatively easy to transfer. If your agency has NAIP data in another format, try a test mosaic to see if the color balance is acceptable. NAIP data are available for download at the NRCS DataGateway or you can send a drive to Scott McClarin at RSAC (smclarin@fs.fed.us).

a. Mosaic CCMs to 100k quads

Open the ERDAS Imagine 2010 'Mosaic Pro' tool and add each of the CCM MrSID files. Set the Overlap Function to 'Maximum'. In the 'Output Options' dialog, set the 'Method' to USGS Maps Database 1:100000 Series, collar extent to 100m, and set the output projection

as desired. In our NV example, we will use UTM NAD83 Zone 11. Set output cell size to 5m and output data type to unsigned 8-bit (Figure 6).

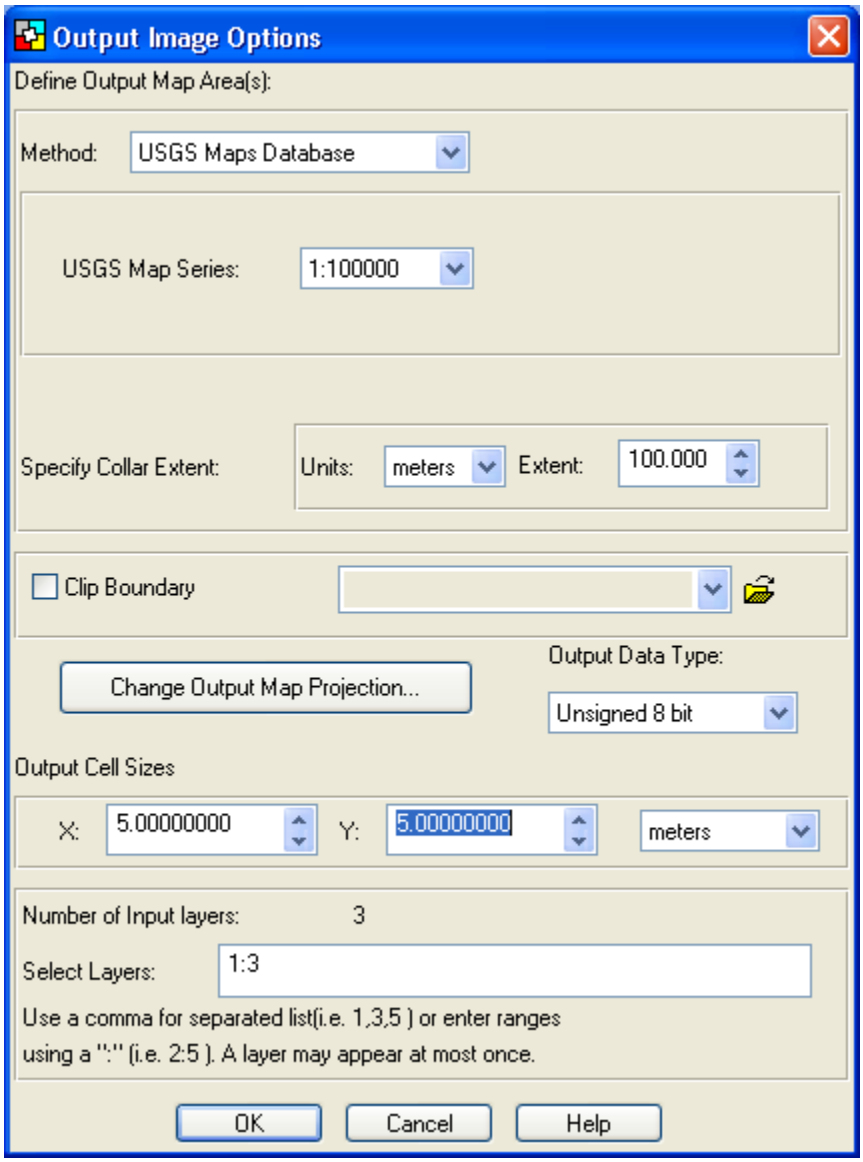

Figure 6. Output options dialog (ERDAS Imagine 2010) for mosiacing CCM files to USGS 100k quads.

b. <u>Run mosaic</u>

When you run the mosaic, you will be prompted for a file name. The file name you enter will be the prefix of the 100k quad name; i.e. if you enter '5m_.img' the quad files created by the mosaic tool will be '5m_<quadname>.img'. When the process has completed, inspect the quads and see if the color balancing is acceptable (Figure 7). The Nevada quads took approximately 35 hours to process.

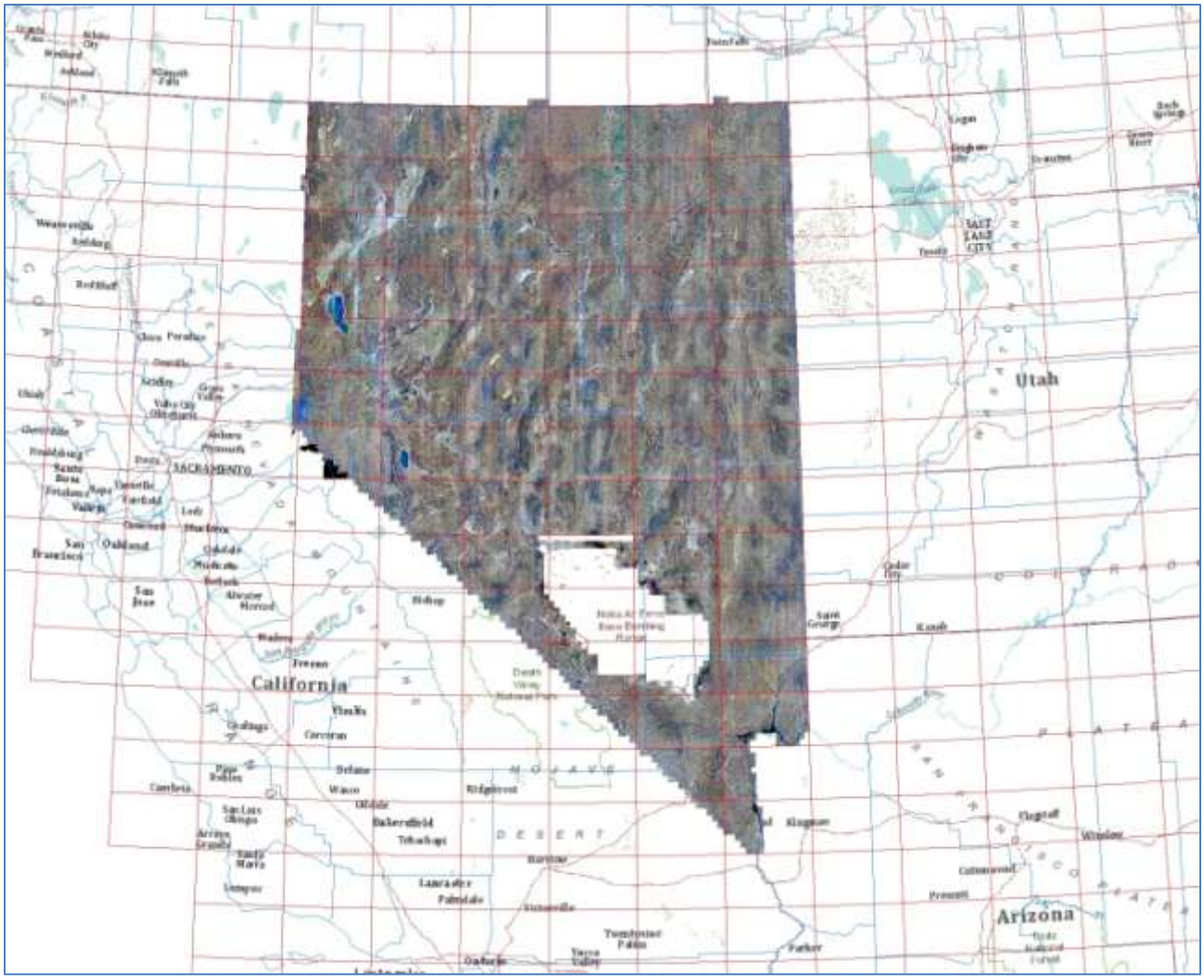

Figure 7. 5m image quads from the NAIP CCM's. The blank area is Nellis Air Force Base, they dont like to have their picture taken.

4. **<u>Burn contour, hydro features into NAIP Quads</u>**

   In steps 1-3 above, we have prepared the three input files that go into making the NAIP image maps. Next we will use an ERDAS model (.mdl) to reclass the contour pixels to yellow and the stream pixels to blue -- "burning" the features into the image quad. Rather than laboriously running the model for each quad, we will use a ERDAS batch commad (.bcf) file to loop through a list of the quads. Here is a diagram of the process (Figure 8):

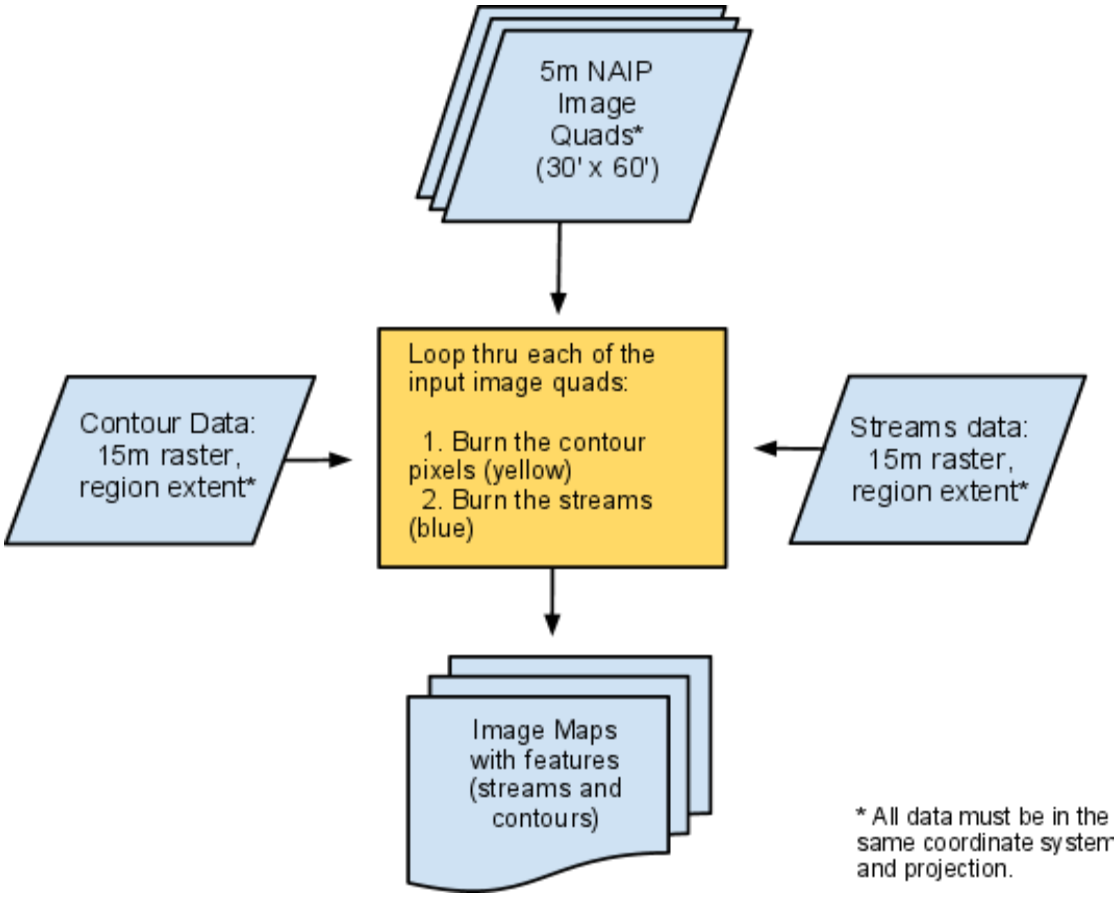

Figure 8. Simplified diagram of the steps conducted by the ERDAS model and batch command file.

The batch command file 1). Defines the inputs and outputs, 2). Calls the model which burns the features and creates the output img file, 3). Creates a world file for the output img file, 4).Exports the img to jpg format and 5). Exports the img to MrSID format (Figure 9).

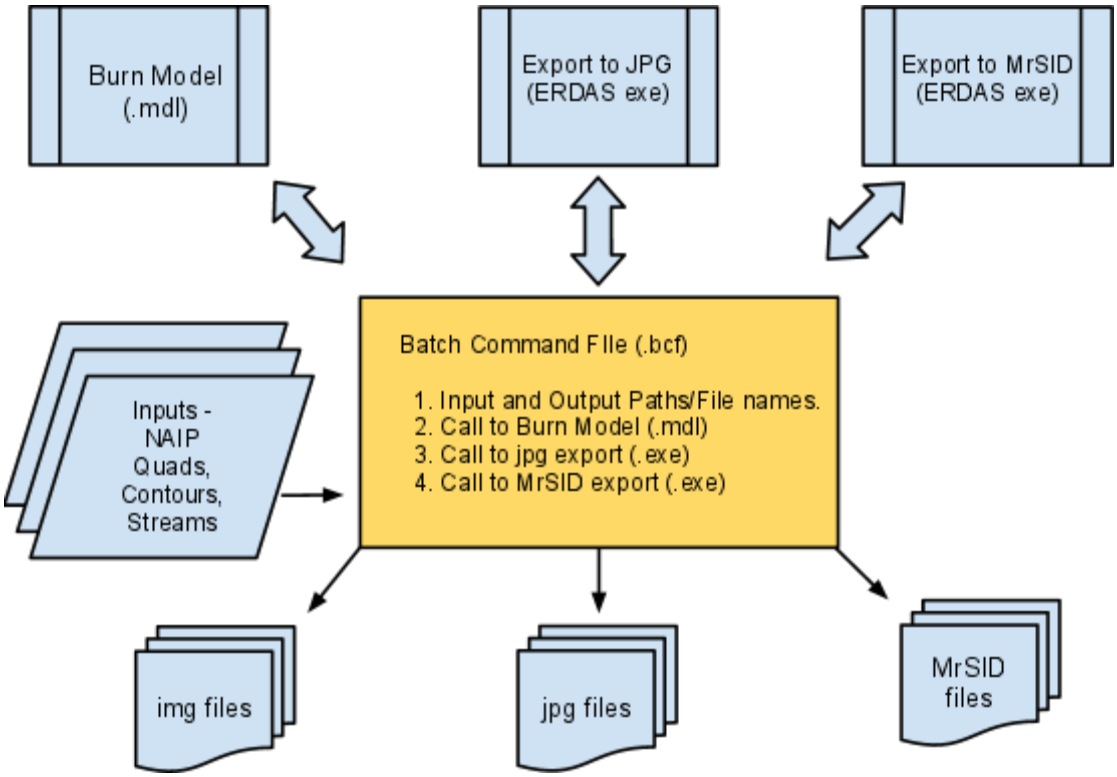

Figure 9. The batch command file is run in ERDAS Imagine 2010 and outputs the image maps in three different formats.

a. <u>Define output folders</u>

First, we need to set up some folders for the output raster burns. The batch command file produces img, jpg and MrSID files so define a folder for each file type. Why three different formats? Exeperience shows that the jpg format retains the contrast and tone of the imagery when converted to the gor format (see below), and the MrSID files are highly compressed and therefore smaller and easier to use in a desktop GIS. The folders created for the NV project are shown in Figure 10:

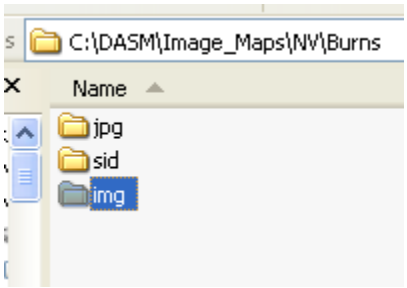

Figure 10. Three output folders were created for the NV maps.

b. Locate the model file

Next, we need to put the burn model (.mdl) in the right place. The model file (NAIP_Hydro_Contour_<date>.mdl) should be placed in your C:/Program Files/ERDAS/ERDAS Desktop 2010/etc/models directory.

c. Edit paths in the batch command file

Both the model and the batch command file are text files and can be edited in WordPad or NotePad. For most projects, editing the model will not be necessary. One situation where the model can be edited is if you want to use different band combinations (See section 5 below).

The paths and filenames in the batch command file will need to be edited for each image map project. These lines should be edited to point to the contour and hydro raster files created in sections 1 and 2 above:

```
** INPUTS - SPECIFY THE REGION HYDRO AND CONTOUR RASTERS
*/
variable INPUT_RASTER_CONTOUR Auto "c:/dasm/image_maps/nv/ned/nv_200m_contours.img";
variable INPUT_RASTER_ORIGINAL User;
variable INPUT_RASTER_STREAMS Auto "c:/dasm/image_maps/nv/hydro/nv_hydro_15m.img";
/*
```

Filenames for the output raster files are auto-generated by ERDAS Imagine, but we still need to specify the output paths for each of the output raster types. Edit the paths in these lines, being careful not to alter any of the text to the right of the $ sign:

```
** OUTPUTS - EDIT THE PATHS TO THE LEFT OF THE $ SIGN
*/
variable OUTPUT Auto "c:/dasm/image_maps/nv/burns2/img/$(INPUT_RASTER_ORIGINAL.root).img"
Delete_Before;
variable OUTPUT_TFW Auto "c:/dasm/image_maps/nv/burns/jpg/$(INPUT_RASTER_ORIGINAL.root).tfw"
Delete_Before;
variable OUTPUT_JPG Auto "c:/dasm/image_maps/nv/burns/jpg/$(INPUT_RASTER_ORIGINAL.root).jpg"
Delete_Before;
variable OUTPUT_SID Auto "c:/dasm/image_maps/nv/burns/sid/$(INPUT_RASTER_ORIGINAL.root).sid"
Delete_Before;
```

These paths should correspond to the ones created in step 4a above. Note that the path switches are forward slashes ("/") rather than back slashes ("\"). When the paths have been edited save the bcf file and close the text editor.

d. Start the batch command

Now we are ready to open ERDAS Imagine 2010 and launch open the batch command file. After Imagine has started, find the Application Menu in the upper left hand corner of the application window. The button to open the menu looks like this:

Application Menu Button

Click on the Application Menu and select 'Batch → Open Batch Command File'. Select the batch command file edited above. The batch command dialog will now be displayed (Figure 11):

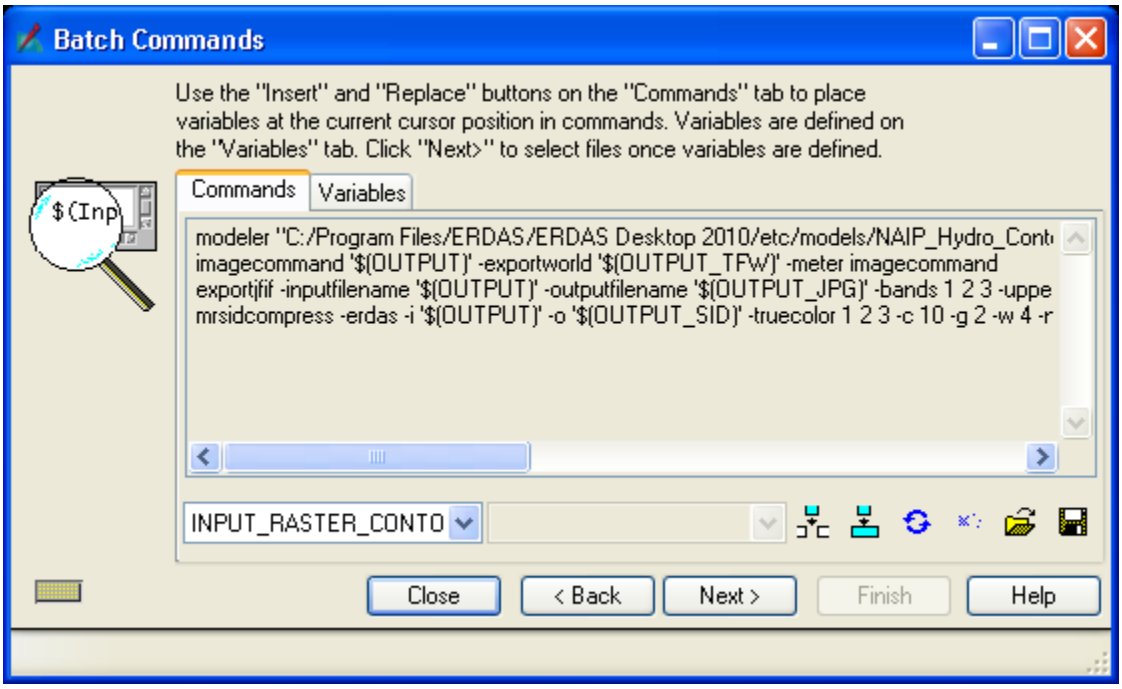

Figure 11. ERDAS Imagine Batch Command dialog.

Click the 'Next' button and use the 'Select Files to Add' dialog button to add the NAIP 100k quads created in step 3 above (Figure 12):

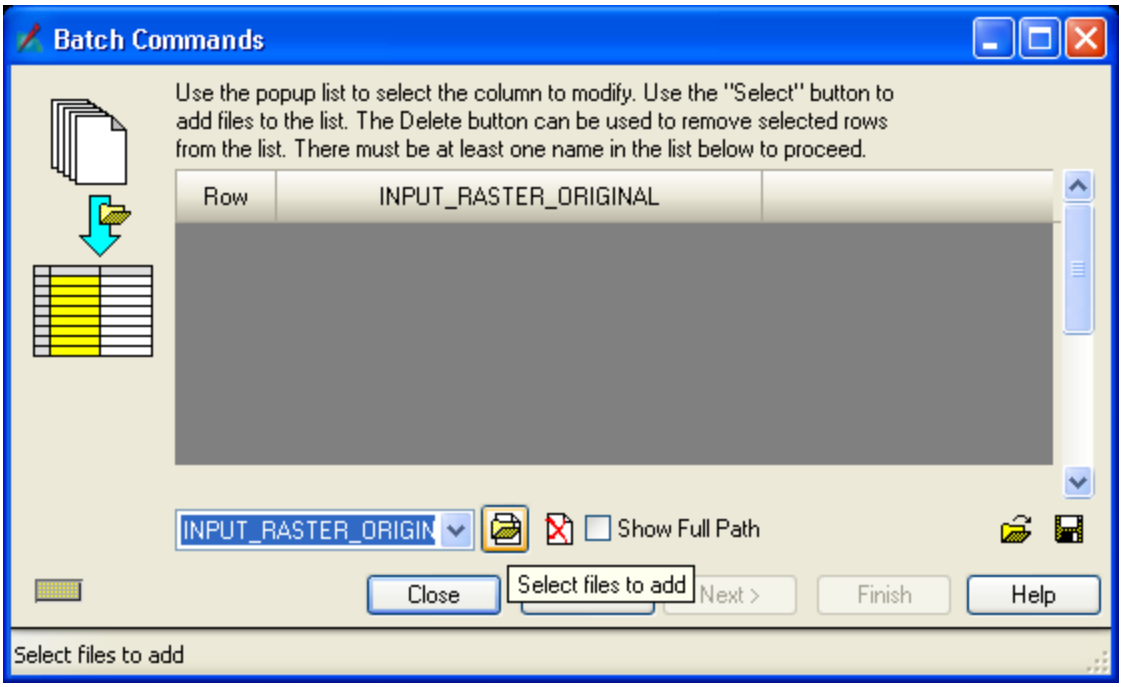

Figure 12. Use the 'Select files to add' button to bring up the dialog to add the NAIP quads to the batch.

Add all of the NAIP 100k quads for your region. For our NV project, all 95 quads for the state of Nevada and bordering areas have been added (Figure 13):

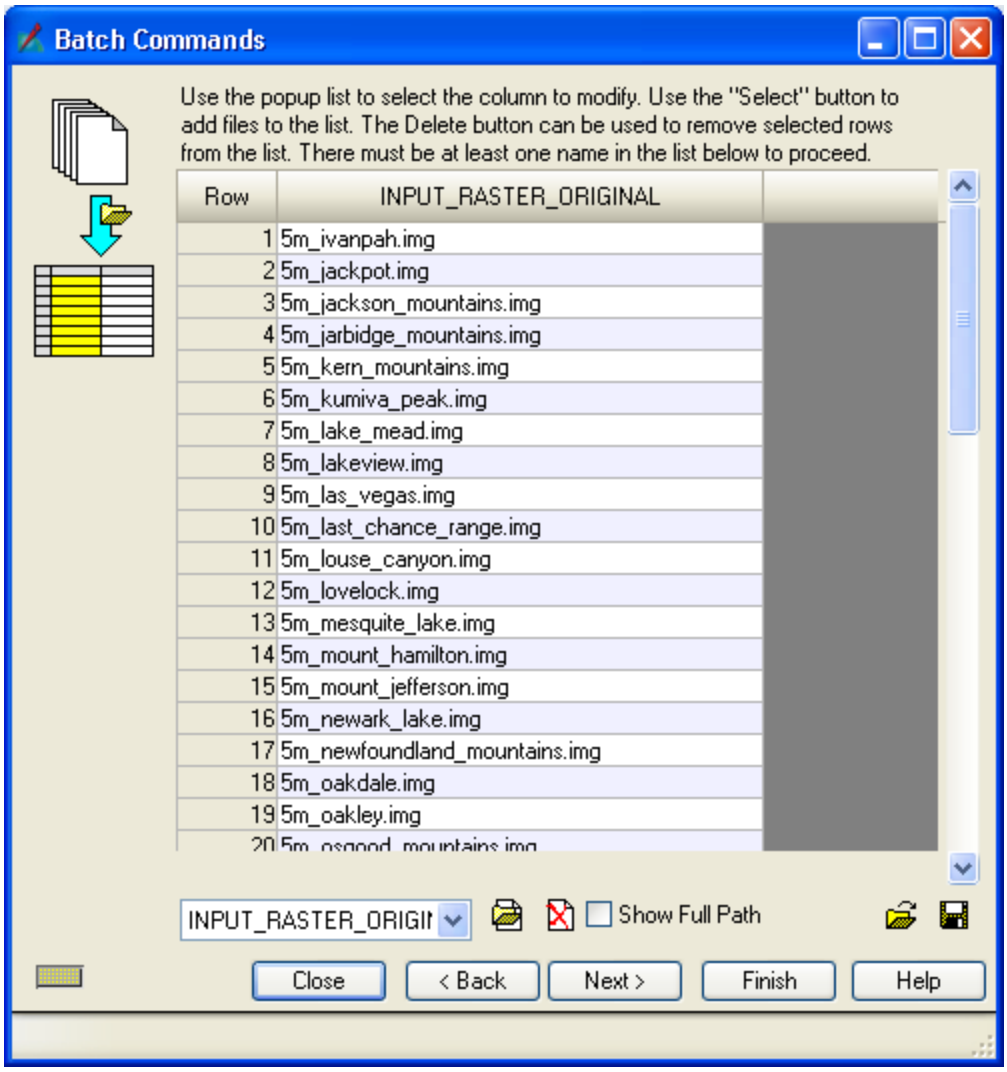

Figure 13. Batch Command Dialog with NVquads added.

Click 'Finish' and the process will start. Our demo NV project took around 5 hours to process and export 95 quads, some of which were not full quads.

When things go wrong (note "when" and not "if") the session log is very handy for diagnostics. Open the session log by clicking the App . Menu, Then selecting 'Session Log' → 'Open Session log'. One of the most common errors is not setting the paths correctly so that is the first thing to check.

After the batch has successfully run, open ArcMap and inspect the processed files.

5. **Edit the NAIP bands used in the burn model (optional)**

   a. If you have 4-band data available, you can edit the model file to use the IR band (4) to create a false color IR image map. Open the model in a text editor and find these lines:

```
# FUNCTION DEFINITIONS
# THE LAYERS IN THE COMMAND BELOW CAN BE CHANGED TO 4,3,2
# PULL THREE LAYERS FROM THE 4-LAYER INPUT
#define n12_memory Integer(STACKLAYERS ( $n12_NAIP(1), $n12_NAIP(2), $n12_NAIP(3) ) )
```

   Change the band assignments in the last line from 1,2,3 to 4,3,2:

```
# FUNCTION DEFINITIONS
# THE LAYERS IN THE COMMAND BELOW CAN BE CHANGED TO 4,3,2
# PULL THREE LAYERS FROM THE 4-LAYER INPUT
#define n12_memory Integer(STACKLAYERS ( $n12_NAIP(4), $n12_NAIP(3), $n12_NAIP(2) ) )
```

   Save the file and close the text editor.

6. **Create the GeoLink Optimized Raster (.gor) files for use in GeoLink GPS Mapping sotfware**

   GeoLink Software (Michael Baker Jr, Inc), requires that large raster files be converted to proprietary format that is optimized for fast, efficient display. This format is called gor - GeoLink Optimized Raster). To create these files, we will use a utility that is bundled with GeoLink that is called SplitTiff. SplitTiff is not a stand-alone application and so GeoLink will need to be loaded on your image processing workstation. Creating gor files using SplitTiff is memory intensive so make sure you have lots of RAM available.

   a. **World files**

   World files are small text files that contain georeferencing and pixel size information. Each jpg raster file must have a corresponding world file with the same filename and with the .tfw extension. Since the jpg files we created have no map model information, the world files were created from the img files in the batch command code. Sort the files by name in the jpg folder (C:\DASM\Image_Maps\NV\Burns\jpg) to make sure each jpg file has a corresponding tfw file.

   b. **Create the gor files**

   Open the SplitTiff utility (Start Menu →GeoLink Mapping System→SplitTiff) and in the window that opens up select 'File →Batch Process'. In the dialog select 'Jpeg' in the 'Files of type' pull down menu and go to your jpg folder. Select all the jpg files (Figure 14):

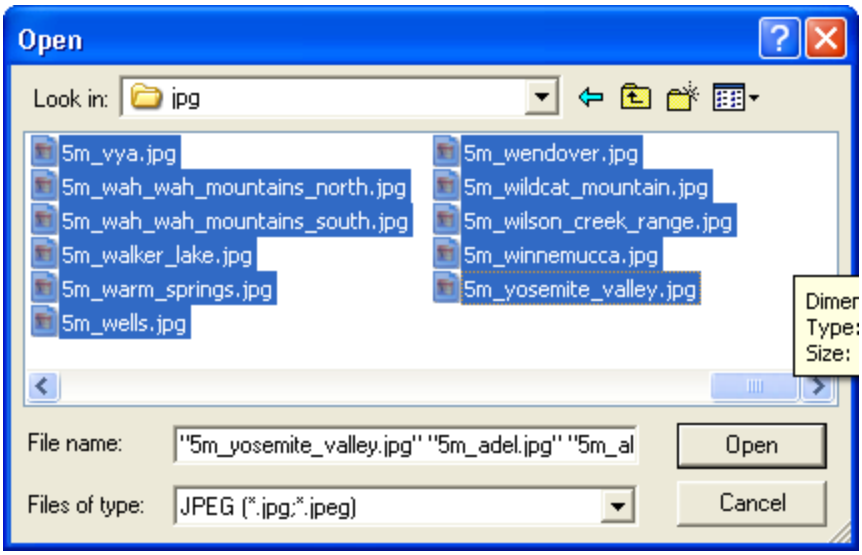

Figure 14. SplitTiff *open file* dialog with NV jpgs added.

Click 'Open' and the following dialog will display (Figure 15). Check the boxes 'Use these settings for all images in this batch' and 'Skip blank images'. Select the 'Pixel elimination' radio button. Accept the default 'Width and Height of images' values. Set the output folder (in our demo, we have created a gor folder in the C:\DASM\Image_Maps\NV\Burns directory). Click 'Ok' and the process will start.

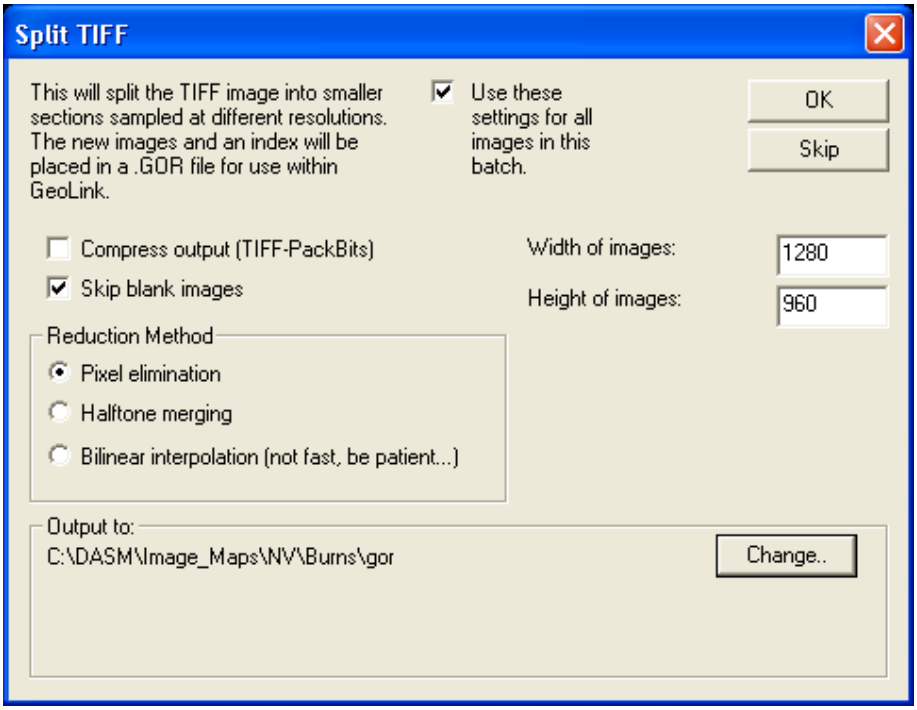

Figure 15. SplitTiff parameters dialog.

Close all other programs to ensure that maximum RAM is available for SplitTiff.
After the gor files have been created, inspect them in GeoLink's 'View/Print Maps' utility (Figures 16 and 17). Be sure to set the coordinate system correctly.

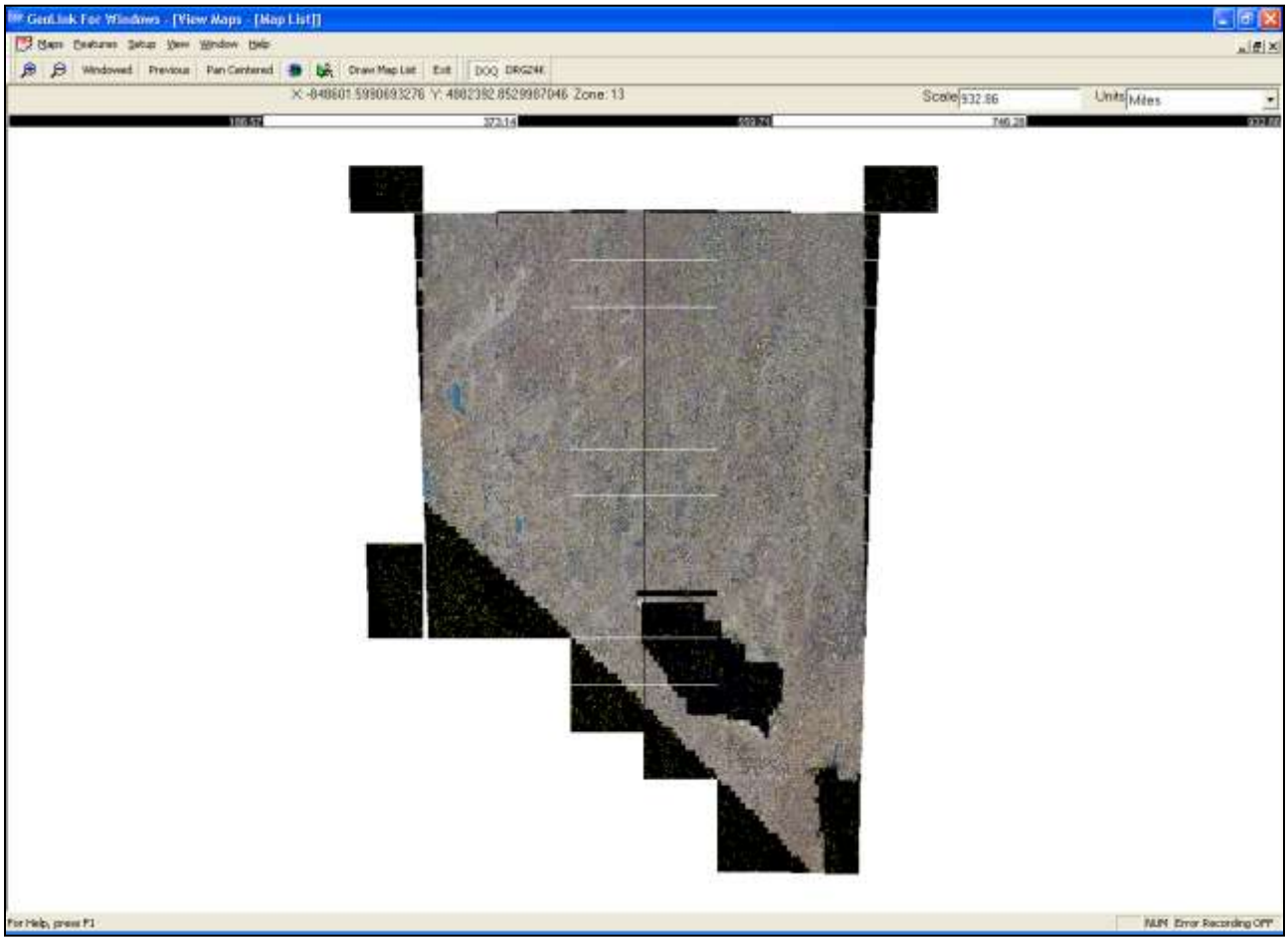

Figure 16. Nevada 200m contour interval with hydrography image maps in GeoLink.

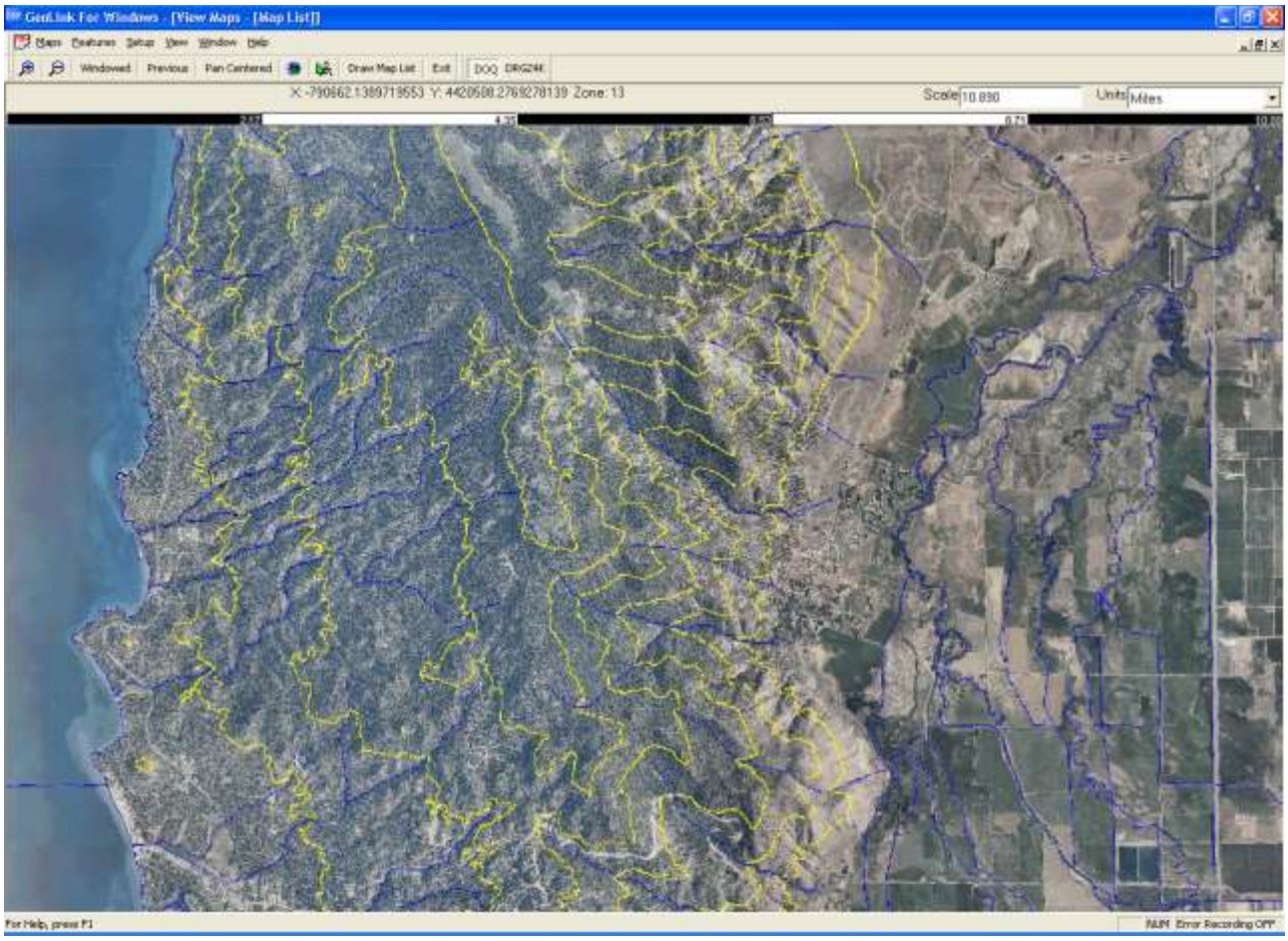

Figure 17. Use GeoLink's 'View/Print Maps' utility to confirm successful creation of the gor files.

Since hydrography and hypsography are relatively static, it is not necessary to re-create these input files each time new NAIP imagery is available. Additionally, these methods can be used to burn other features into NAIP imagery – roads, railroads, power lines, etc.

This document will be updated periodically. Please contact us and provide feedback on how these methods worked for you; these comments will help improve future versions of this document.

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DASM support is a cooperative effort between the USFS Remote Sensing Applications Center, USFS Forest Health and Technology Enterprise Team, and Michael Baker Jr., Inc.

Appendix A - NAIP_Hydro_Contour.bcf

```
** INPUTS - SPECIFY THE REGION HYDRO AND CONTOUR RASTERS
*/
variable INPUT_RASTER_CONTOUR Auto "c:/dasm/image_maps/nv/ned/nv_200m_contours.img";
variable INPUT_RASTER_ORIGINAL User;
variable INPUT_RASTER_STREAMS Auto "c:/dasm/image_maps/nv/hydro/nv_hydro_15m.img";
/*
** OUTPUTS - EDIT THE PATHS TO THE LEFT OF THE $ SIGN
*/
variable OUTPUT Auto "c:/dasm/image_maps/nv/burns2/img/$(INPUT_RASTER_ORIGINAL.root).img"
Delete_Before;
variable OUTPUT_TFW Auto "c:/dasm/image_maps/nv/burns/jpg/$(INPUT_RASTER_ORIGINAL.root).tfw"
Delete_Before;
variable OUTPUT_JPG Auto "c:/dasm/image_maps/nv/burns/jpg/$(INPUT_RASTER_ORIGINAL.root).jpg"
Delete_Before;
variable OUTPUT_SID Auto "c:/dasm/image_maps/nv/burns/sid/$(INPUT_RASTER_ORIGINAL.root).sid"
Delete_Before;
** START THE MODEL
*/
modeler "C:/Program Files/ERDAS/ERDAS Desktop 2010/etc/models/NAIP_Hydro_Contours_20111201.mdl" -s -m
"$(INPUT_RASTER_CONTOUR)" "$(INPUT_RASTER_ORIGINAL)" "$(INPUT_RASTER_STREAMS)"
"$(OUTPUT)"
exportjfif -inputfilename '$(OUTPUT)' -outputfilename '$(OUTPUT_JPG)' -bands 1 2 3 -upperleft '$(OUTPUT.ulx)'
'$(OUTPUT.uly)' -lowerright '$(OUTPUT.lrx)' '$(OUTPUT.lry)' -coordinatetype MAP -quality 100
mrsidcompress -erdas -i '$(OUTPUT)' -o '$(OUTPUT_SID)' -truecolor 1 2 3 -c 10 -g 2 -w 4 -n 6 -b 32 -gen 3
```

Appendix B - NAIP_Hydro_Contours_20111201.mdl

```
# BURN HYDRO (RASTER) AND CONTOUR (RASTER) INTO NAIP IMAGERY
# INPUTS:
#   15M RASTER CONTOUR FILE
#   15M RASTER HYDRO (STREAMS) FILE
#   5M NAIP IMAGERY FILES
# ALL INPUTS IN THE SAME PROJECTION
#
#
# set cell size for the model
#
SET CELLSIZE MIN;
#
# set window for the model
# LINE 20
SET WINDOW INTERSECTION;
#
# set area of interest for the model
#
SET AOI NONE;
#
# DECLARE THE INPUTS
# INPUT THE RASTER CONTOURS AS ARGUMENT 1
Integer RASTER n20_HYPS FILE OLD NEAREST NEIGHBOR AOI NONE arg1;
#
# INPUT THE NAIP USGS QUAD AS ARGUMENT 2
Integer RASTER n12_NAIP FILE OLD NEAREST NEIGHBOR AOI NONE arg2;
#
# INPUT THE RASTER STREAMS AS ARGUMENT 3
Integer RASTER n34_streams FILE OLD NEAREST NEIGHBOR AOI NONE arg3;
#
# SPECIFY THE NAME OF THE FINAL OUTPUT (ARG 4)
Integer RASTER n26_final FILE NEW USEALL ATHEMATIC 8 BIT UNSIGNED INTEGER arg4;
# LINE 35
#
# FUNCTION DEFINITIONS
# THE LAYERS IN THE COMMAND BELOW CAN BE CHANGED TO 4,3,2
# PULL THREE LAYERS FROM THE 4-LAYER INPUT
#define n12_memory Integer(STACKLAYERS ( $n12_NAIP(1), $n12_NAIP(2), $n12_NAIP(3) ) )
#
#
#
# CHANGE ANY "0" PIXELS IN THE INPUT IMAGE TO 1 (N29) --STUBBED OUT
# define n29_memory Integer(EITHER 1 IF ( $n12_NAIP == 0 ) OR ($n12_NAIP) OTHERWISE )
#
# LINE 46
# BURN THE CONTOURS(N20) IN (N3)
#define n3_memory Integer(EITHER (COLOR (255,255,0)) IF ( $n20_HYPS > 0 ) OR ( n12_memory ) OTHERWISE )
#
# BURN THE STREAMS (N38) IN
n26_final =  EITHER (COLOR  (0,0,255)) IF ( $n34_streams > 0 ) OR ( $n3_memory ) OTHERWISE;
QUIT;
#
# CONTRAST ADJUST (STUBBED OUT)
# n26_final = RASTERMATCH ($n28_memory, USEALL,  $n12_NAIP , USEALL ) ;
# QUIT;
```

Appendix C – Creating Image Maps – No feature burns

This section outlines the process for creating image maps for GeoLink (GL) from NAIP aerial photography digital files for use in the Digital Aerial SketchMapping (DASM) system.

COMPILE NAIP IMAGE DATA

The first step is getting the NAIP data you need. One source is the USDA NRCS Data Gateway (http://datagateway.nrcs.usda.gov/). On this site the Compressed County Mosaics (CCMs) can be ordered. When your order is fulfilled, you will receive and email with an FTP link to download. There is a limit of something like 4GB per order and 5 or so orders at a time. So if you are downloading an entire state, it may take some time. Your agency/department may have the NAIP data available somewhere on a drive that you can access. The CCMs typically are in the MrSID compressed format and are 1m in resolution. We have had good success using these files in the past. You may have data available at higher spatial resolution. Unless there is a compelling reason, we don't recommend using these data as we will be resampling to 5m anyway (optimal resolution for fixed wing surveys), and the higher resolution files are much larger and more difficult to store and process.

The NAIP CCMs will come in zip files; extract the contents of these to a folder. It is helpful to build an ArcMap document with 100k quads (we will be building the image maps as 100k (30 x 60 degree)quads and other reference layers; load the CCM files to make sure you have coverage for the quads you want to build:

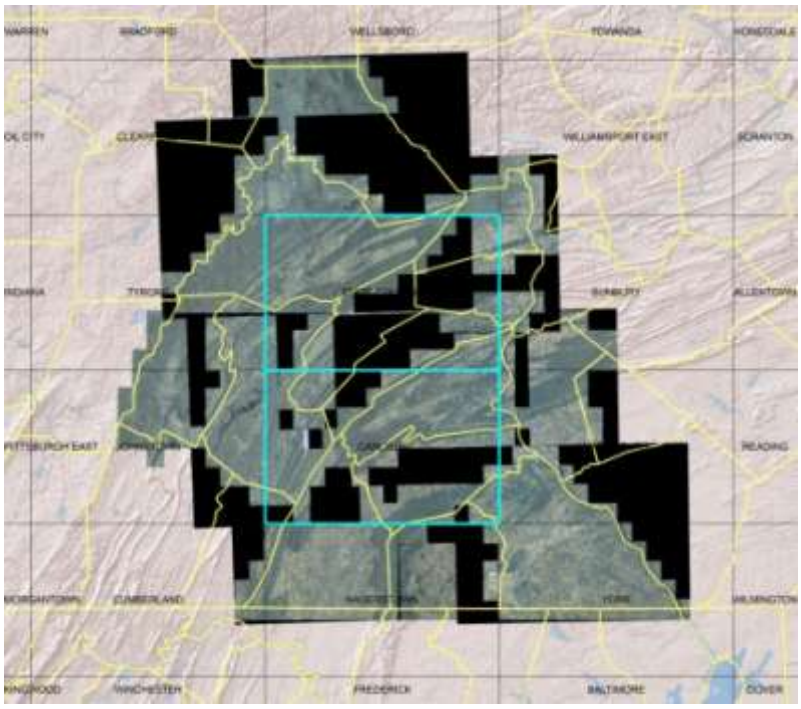


Figure 1 CCMs covering the extent of two quads in PA.

The CCMs have background values that are zeros for all three bands; these areas border the actual image data and will appear black. If you want to make sure that you have adequate

coverage for your quads, you can set the background values to 'No color' for each of the images in ArcMap (Fig 2). In this example we will build the two highlighted quads in Figs 1 and 2.

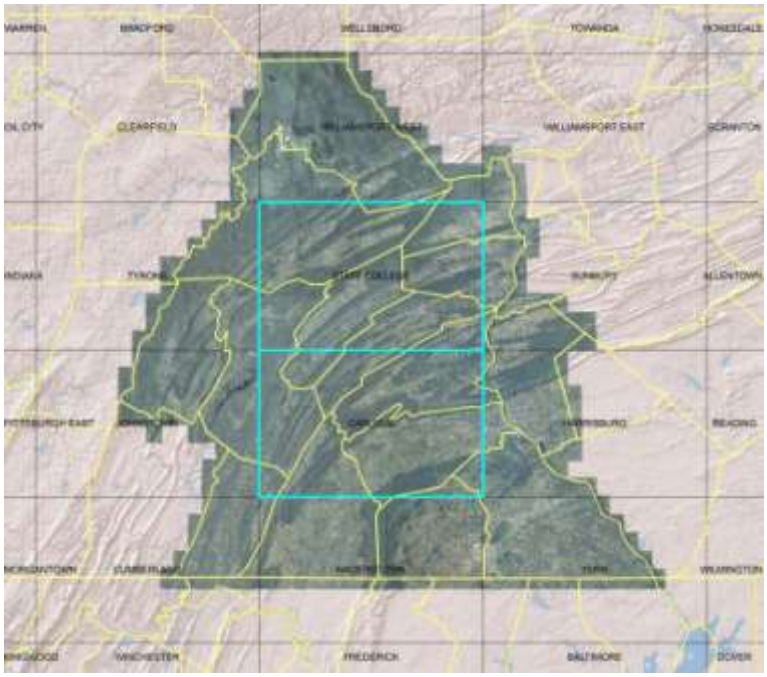


Figure 2. CCM coverage for the Carlisle and State College 100k quads in PA.

RESAMPLE/REPROJECT

The next step is to resample the 1m NAIP imagery to 5m. Also in this step we will convert the MrSID format (.sid) to the ERDAS Imagine (.img) format. The NAIP CCMS are typically projected in their native UTM zones which can be confusing in states like PA that span different UTM zones. Things are much simpler if you decide on a single UTM zone for your state/area of interest. In this example, there are two UTM zones (17 and 18) in PA. We will choose UTM NAD83 Zone 17 as the coordinate system for these quads.

Open ERDAS Imagine 2010 (Classic interface, which should be similar to older versions of Imagine) and select the reproject utility ('Data Prep' button at the top). In this example, here is how the dialog is set up:

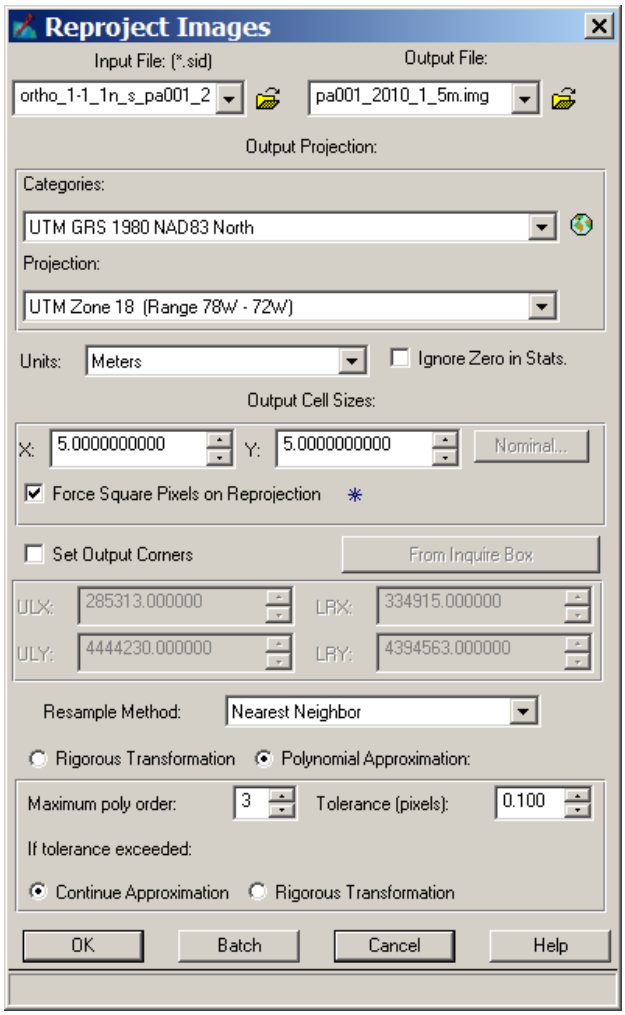


Figure 3. Use the 'Reproject' utility in Imagine to both resample and reproject the CCMs into .img files.

Since we have 13 or so CCMs to do, we will set up a batch process. When doing large batch runs, make sure that you have enough disk space for the produced output. Click the 'Batch' button, select the 'Modify commands automatically' radio button then click 'Next'. Now click the 'Variables' tab:

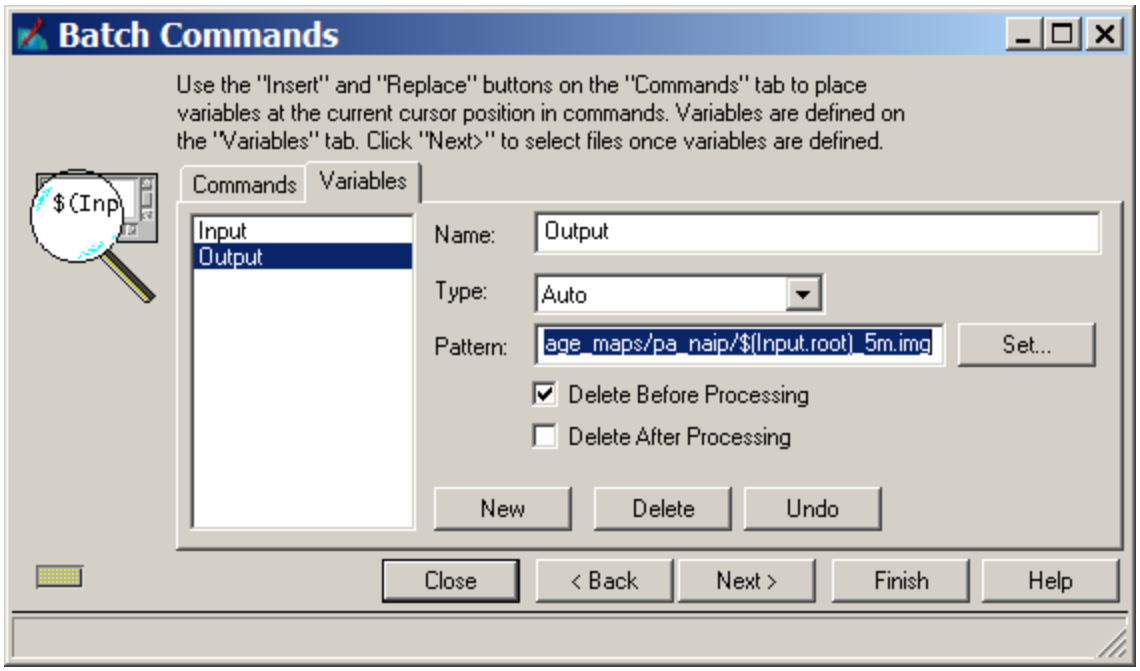


Figure 4. Set the Output variable in the batch command dialog.

For the 'Output' variable, set the pattern so that the filename reads '$(Input.root)_5m.img' . This will set the output file names to the input file name with a '_5m' added. Click 'Next' and in this dialog you will select the CCM files to batch process.

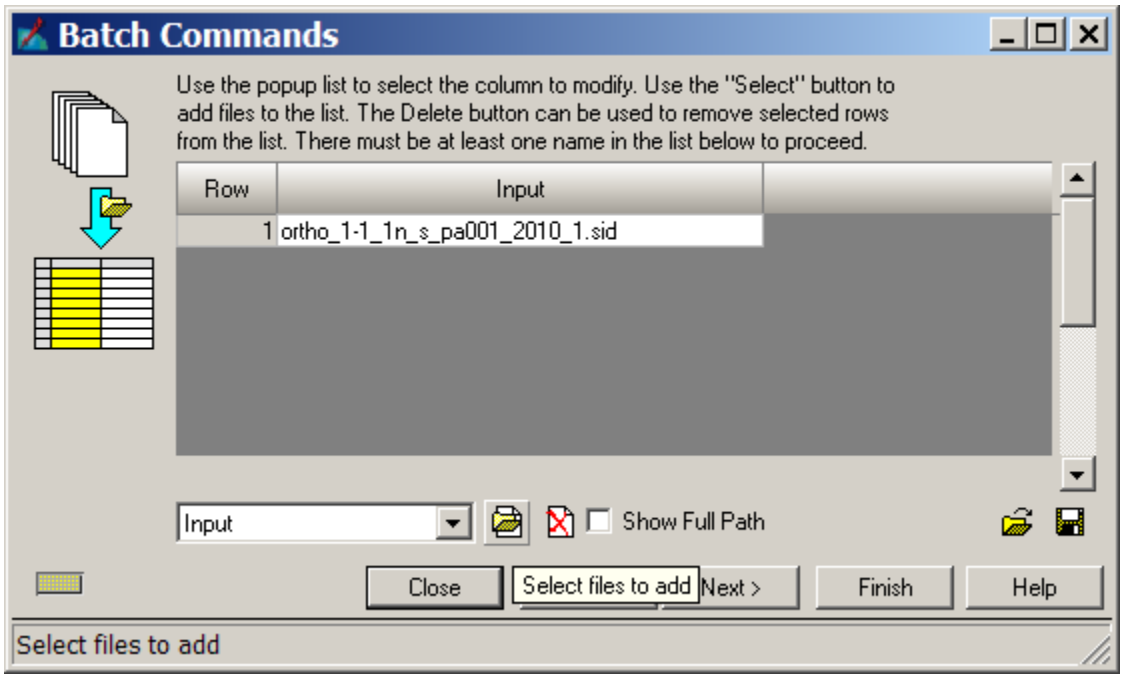


Figure 5. Add all the files for the batch process using the 'Select files to add' button.

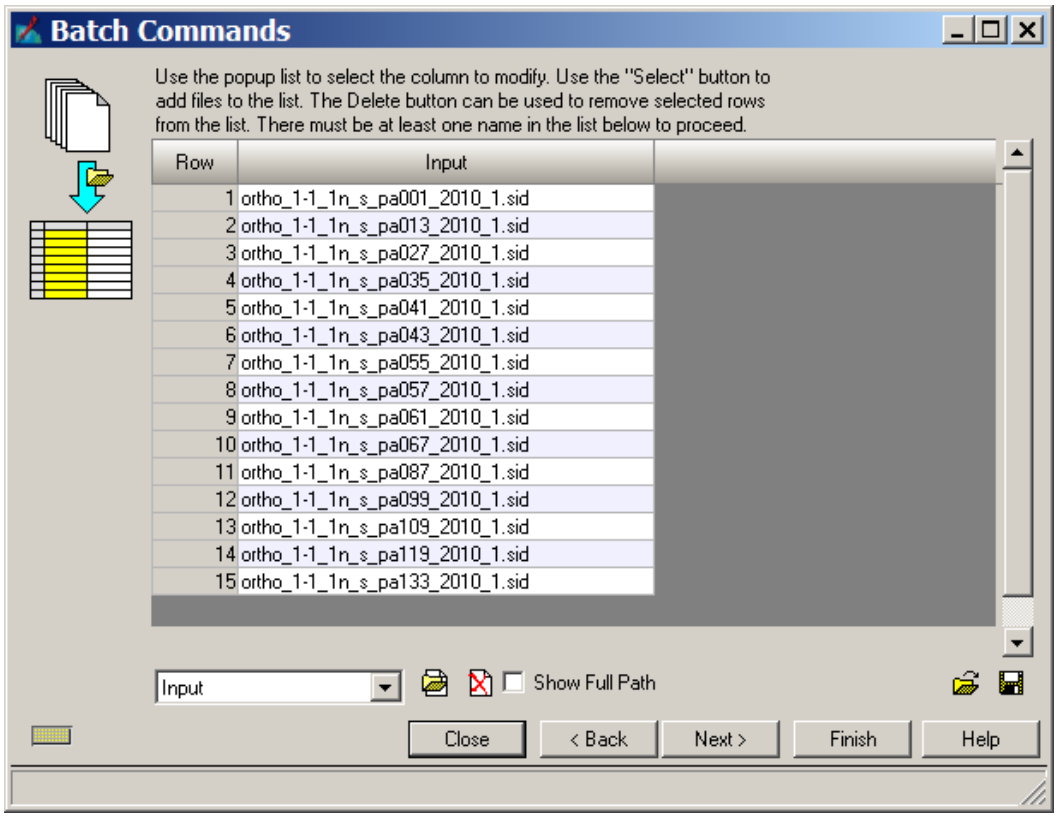


Figure 6. Final dialog of the batch process utility for the resample/reproject step.

Click 'Finish' and the process will run for approximately 1.5 hours per GB of CCM data (this example ran for 16 hours).

MOSAIC AND CLIP TO 100K QUAD BOUNDARIES

Now we have the county mosaics resampled to 5m resolution and all in the same coordinate system. We are ready to mosaic them together and clip to the quad boundaries. Open the 'MosaicPro' tool in ERDAS Imagine 2010 and go to 'Edit' then 'Add Images'. Add all the 5m img files.

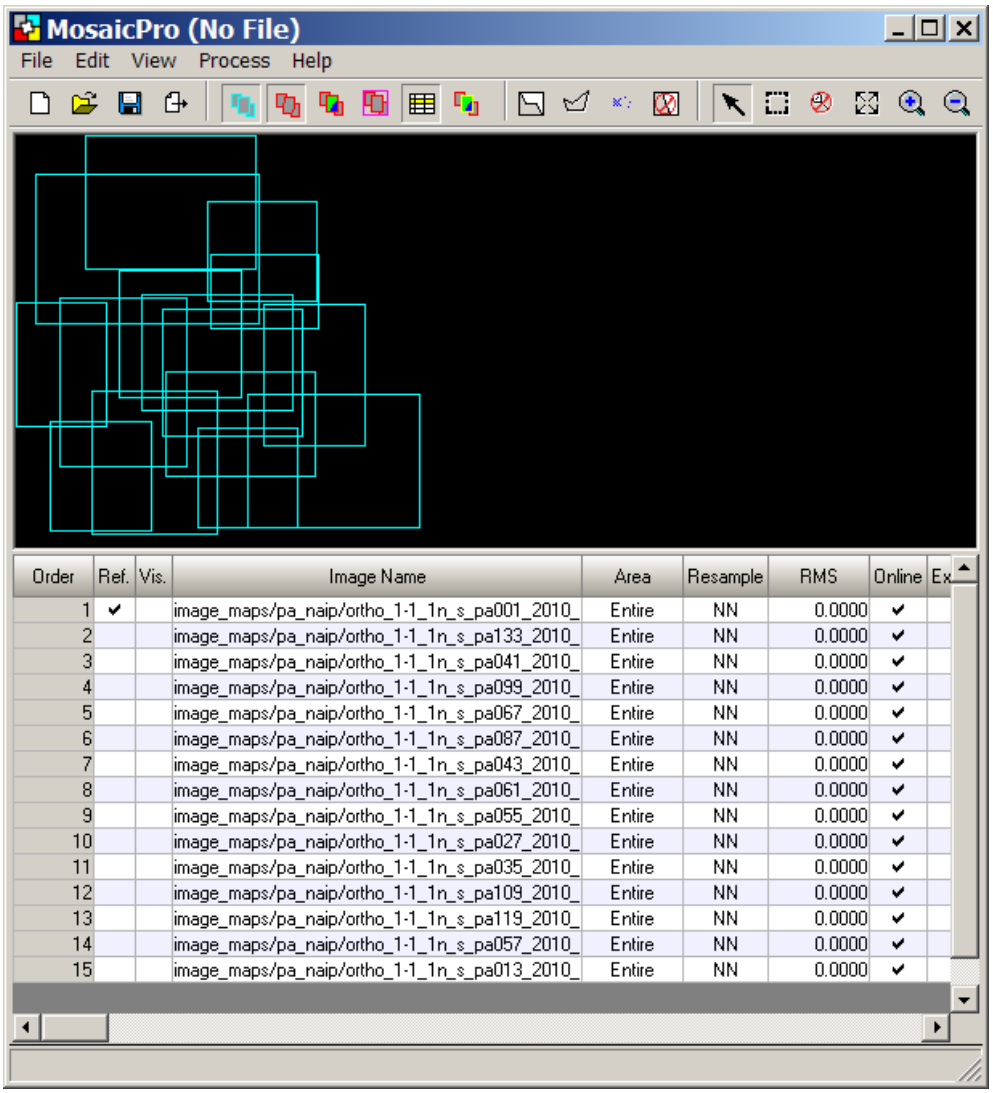


Figure 7. Add all the appropriate 5m county NAIP files in the mosaic dialog.

Now go to ‘Edit’ then ‘Output options’ and set the dialog to output the 100k quads. Also specify a 100 pixel boundary so there are no gaps between the quads (Figure 8).

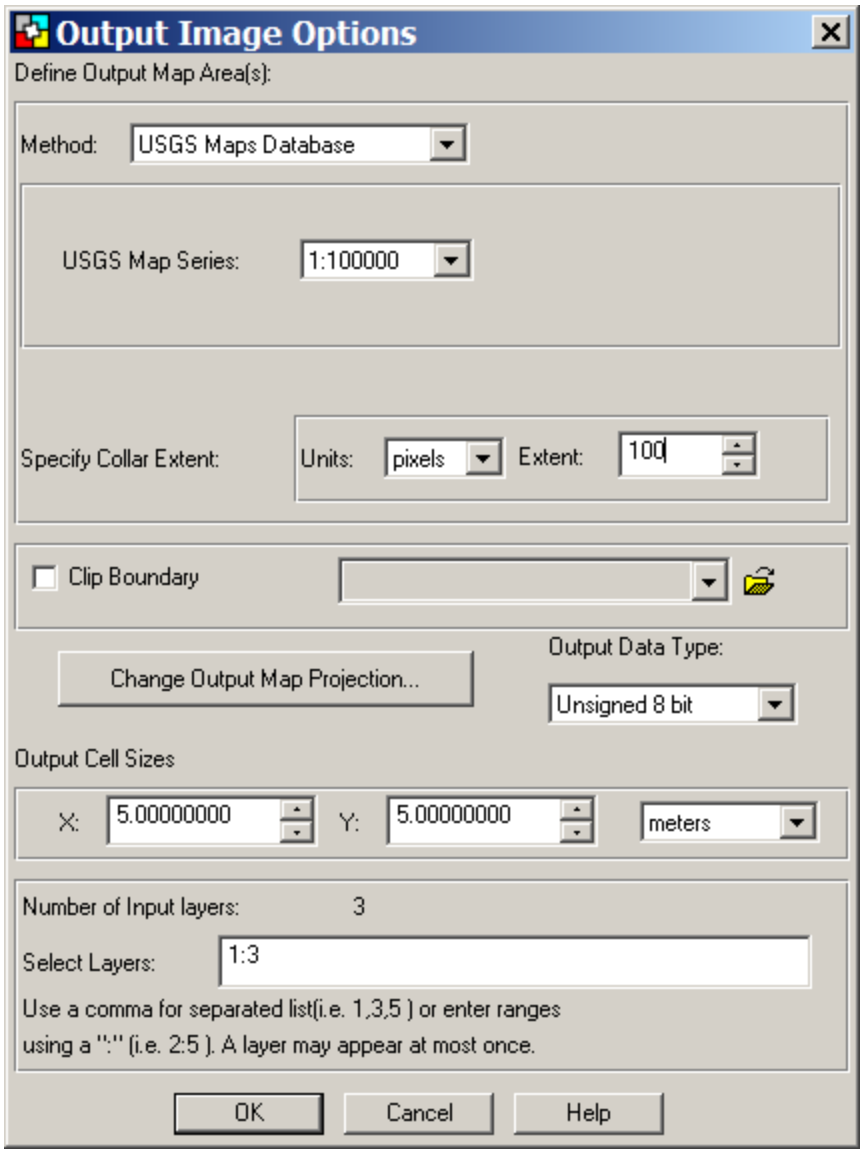


Figure 8. Set the output options for the mosaic process.

Start the mosaic by selecting 'Process' -> 'Run Mosaic'. You will be prompted for a filename; this will be the prefix for the output quads. So we will enter "PA_.img" as the output and the files will be named PA_<quadname>.img. The mosaic and clip takes less time than the resample; about 20 minutes for this demo dataset.

Before proceeding, it is a good idea to look at a few of the 100k 5m image quads in ArcMap just to make sure that they look good. If so, the next step is to make world files for the image quads. World files are small text files that contain pixel size and corner coordinate information; some software applications (like GeoLink) require them to properly georegister images. To make the world files, use the image command tool in ERDAS (Tools -> Image Command).

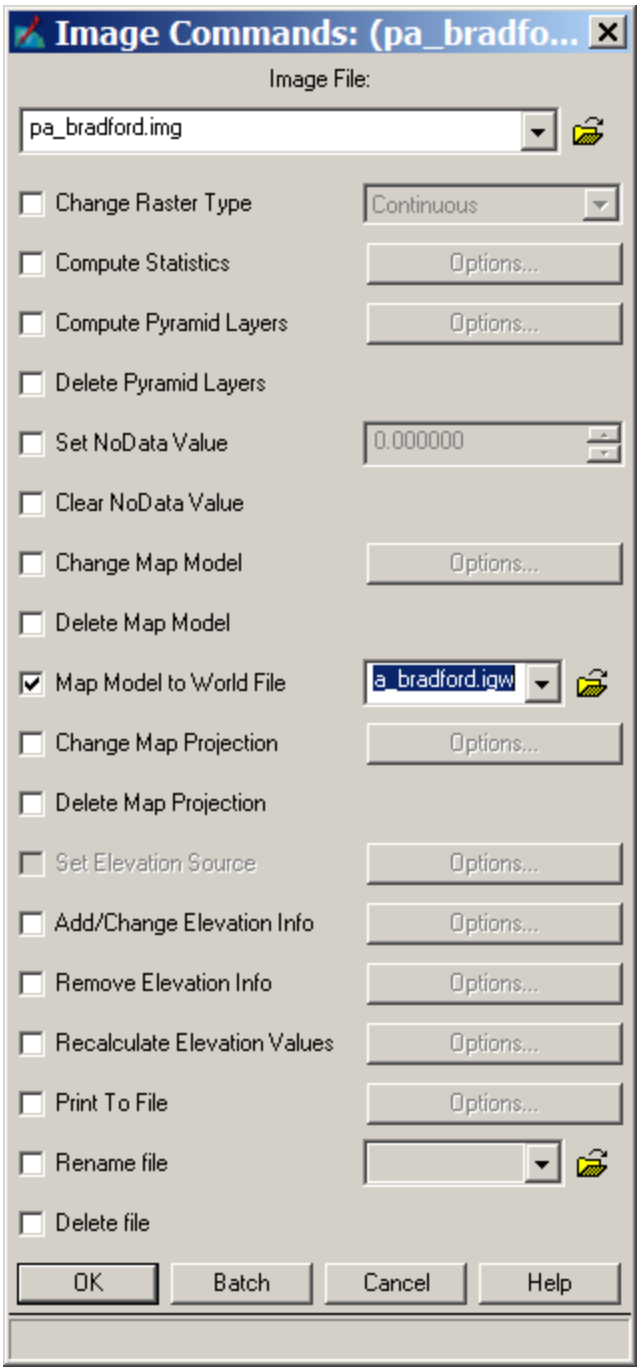


Figure 9. Use the image command tool to make the world files (.tfw).

Select one of your quad images, check the 'Map Model to World File' button and the click the 'Batch' button. We will batch this process as above. Click the 'Modify commands automatically' and then the 'Next' button. In the dialog that appears, select the 'Variables' tab:

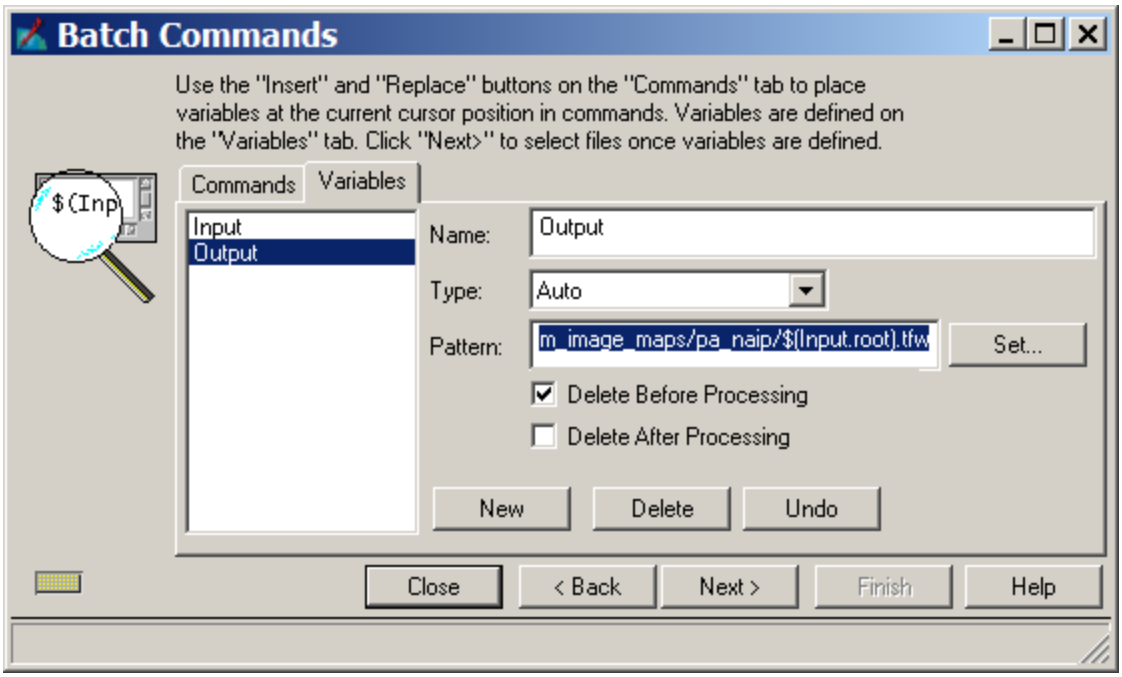


Figure 10. Make sure the output variable for the world files batch is $(Input.root).tfw.

Highlight the 'Output' variable and make sure the output file name is $(Input.root).tfw. GeoLink world files need to have the tfw extension regardless of what raster type they reference. Click 'Next' and in the next dialog select all of the PA_<quadname> .img files and then click 'Finish'. You should now have a world file (PA_<quadname>.tfw) for each of the img files in the output directory.

Now we will make jpg files from the img files, which will then be used to create gor (GeoLink Optimized Raster) files that can be used in GeoLink. Click the 'Import' button on the mail tool bar and select 'JFIF(JPEG)' as the output type; then select your input/output and click the 'Ok' button:

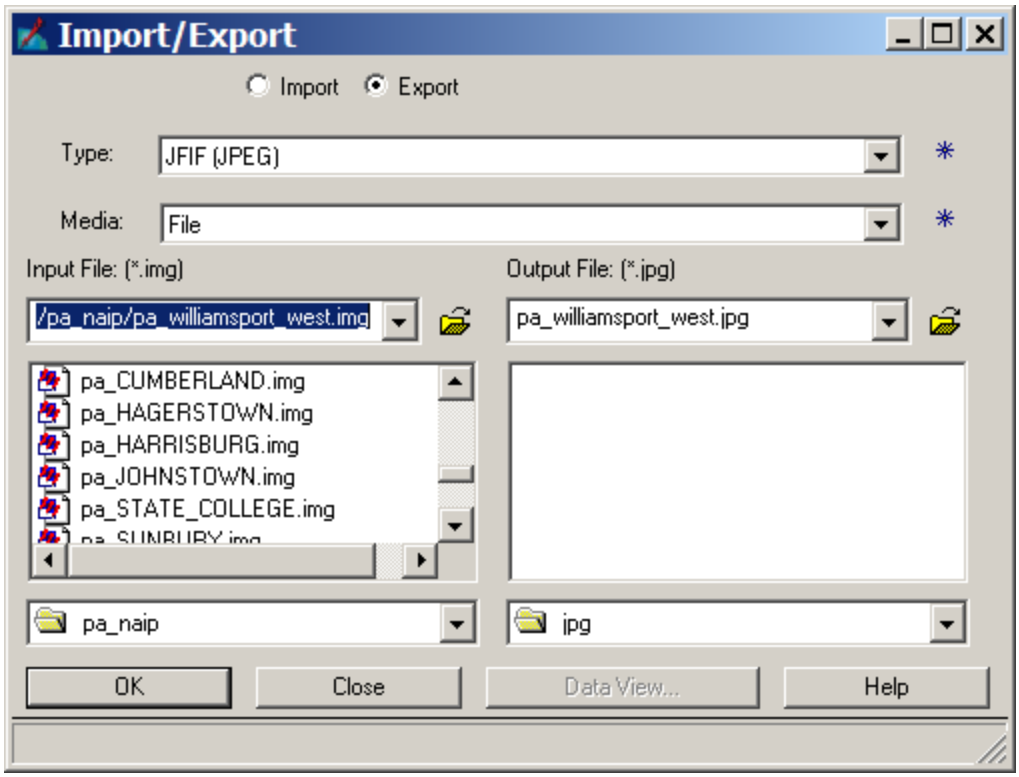


Figure 11. Initial dialog for export to jpeg files from img files.

Next, you will see this dialog:

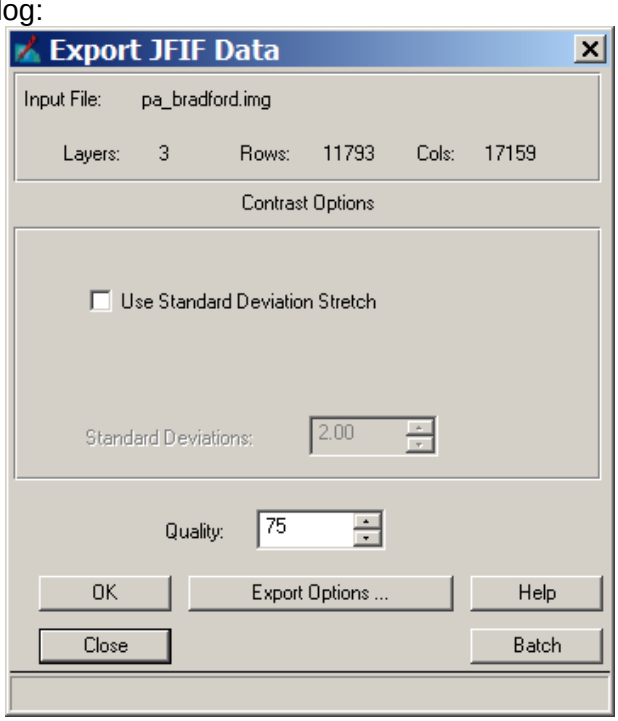


Figure 12. Dialog for jpeg export options.

Make sure the 'Use Standard Deviation Stretch' is NOT checked – it will be checked by default. Accept the default quality setting of 75. Click the 'Batch' button and set up the output file name variable to $(Input.root).jpg:

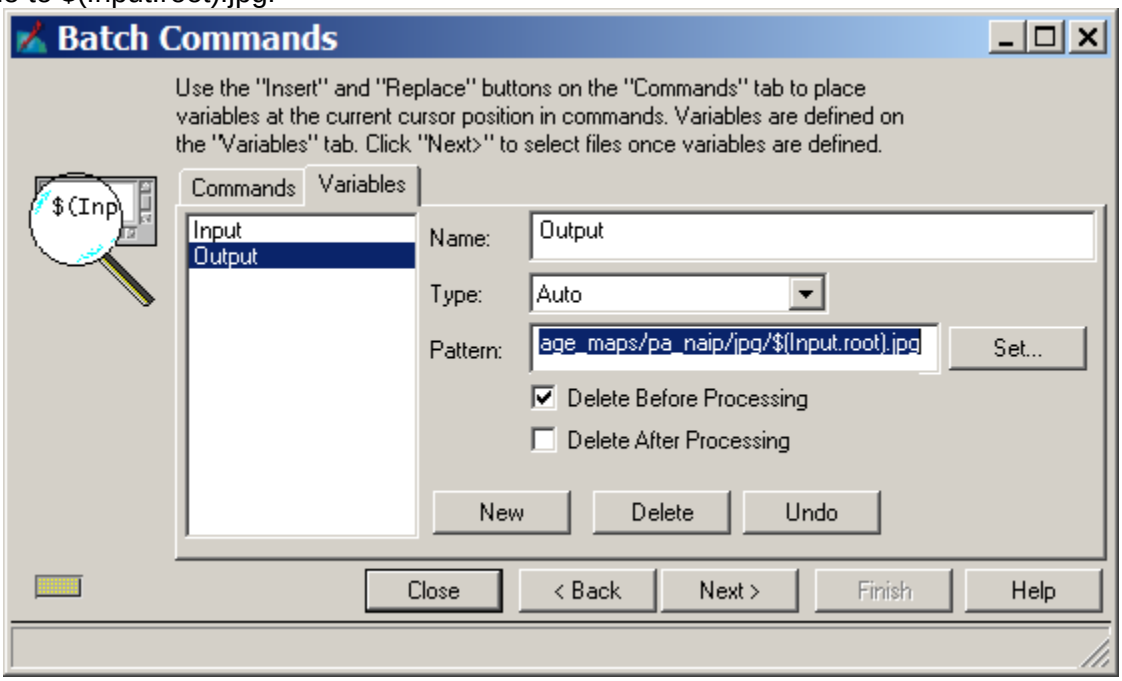


Figure 13. Be sure to set the output file name to $(Input.root).jpg

Click 'Next' and in the next dialog add all the img quad files to export to jpg. Click 'Finish' and when the jpgs have been created, make sure they are in the same folder as the tfw files made in the step above:

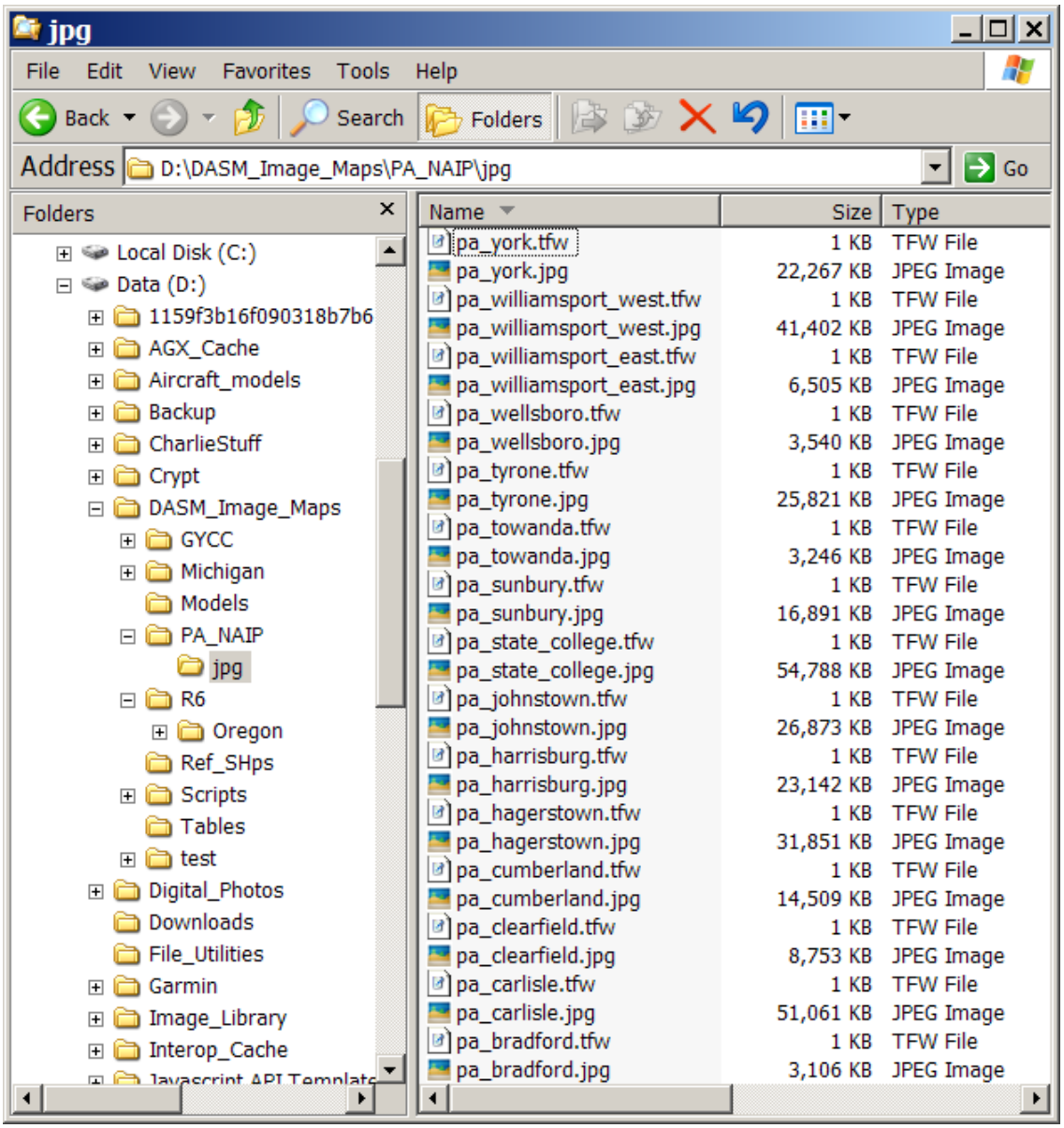


Figure 14. There should be a companion .tfw file for every .jpg file.

Now we are ready to move to GeoLink and create the gor files. SplitTiff is a utility that is installed with GeoLink. If you haven't already, install GeoLink on your desktop workstation. Creating gor files requires considerable memory that might not be available on a survey tablet PC. SplitTiff is fully functional without a GeoLink license key or code. Launch the program from the start menu *Start->All Programs->GeoLink Mapping System-> SplitTiff.* From the bare-bones user interface, select 'File->Batch Process' and add all the jpg files.

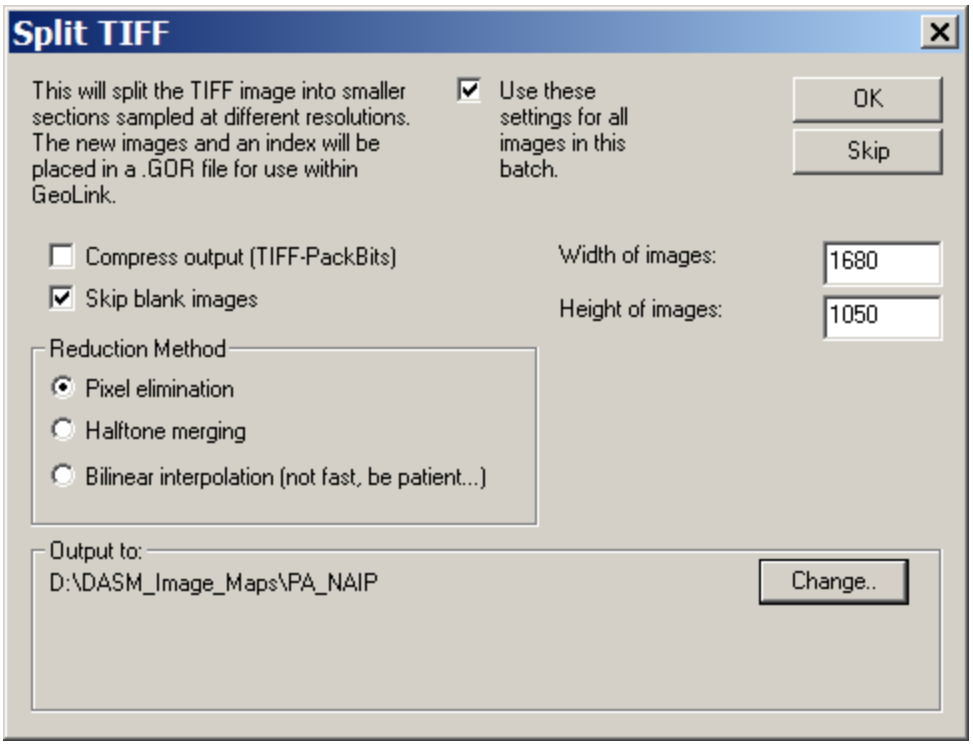


Figure 15. Settings for the SplitTiff utility.

After the jpg files load, a dialog box appear (Figure 15). Set the output folder as desired, making sure there is enough disk space. Accept the default settings that come up for the width and height of images (they are based on your screen resolution), and select 'Pixel Elimination' for the Reduction Method, check 'Skip blank images' and do NOT select 'Compress output'. Check the box that says 'Use these settings for all images in this batch'. Click 'Ok' to start the process. When the processing is complete, the SplitTiff window will read 'Split complete' in the title bar. Go to the output folder to confirm creation of the gor files.

Lastly, confirm that your gor files are working properly by displaying them in GeoLink. You can do this by either opening them in a simulated log session (with or without GPS), or using 'View/Print Maps'. View/Print maps is buggy so if you don't have success, try a log session. Be sure to set the coordinate system for the gor files – GeoLink cant display data properly unless it "knows" what the projection is. Also, be sure to use the 'Cropping' function as it will eliminate any blank (black) areas between the images. Add another dataset to the map list to confirm that the new gor files are georegistering properly. In this example, we have added a quad boundary shapefile (Figure 16).

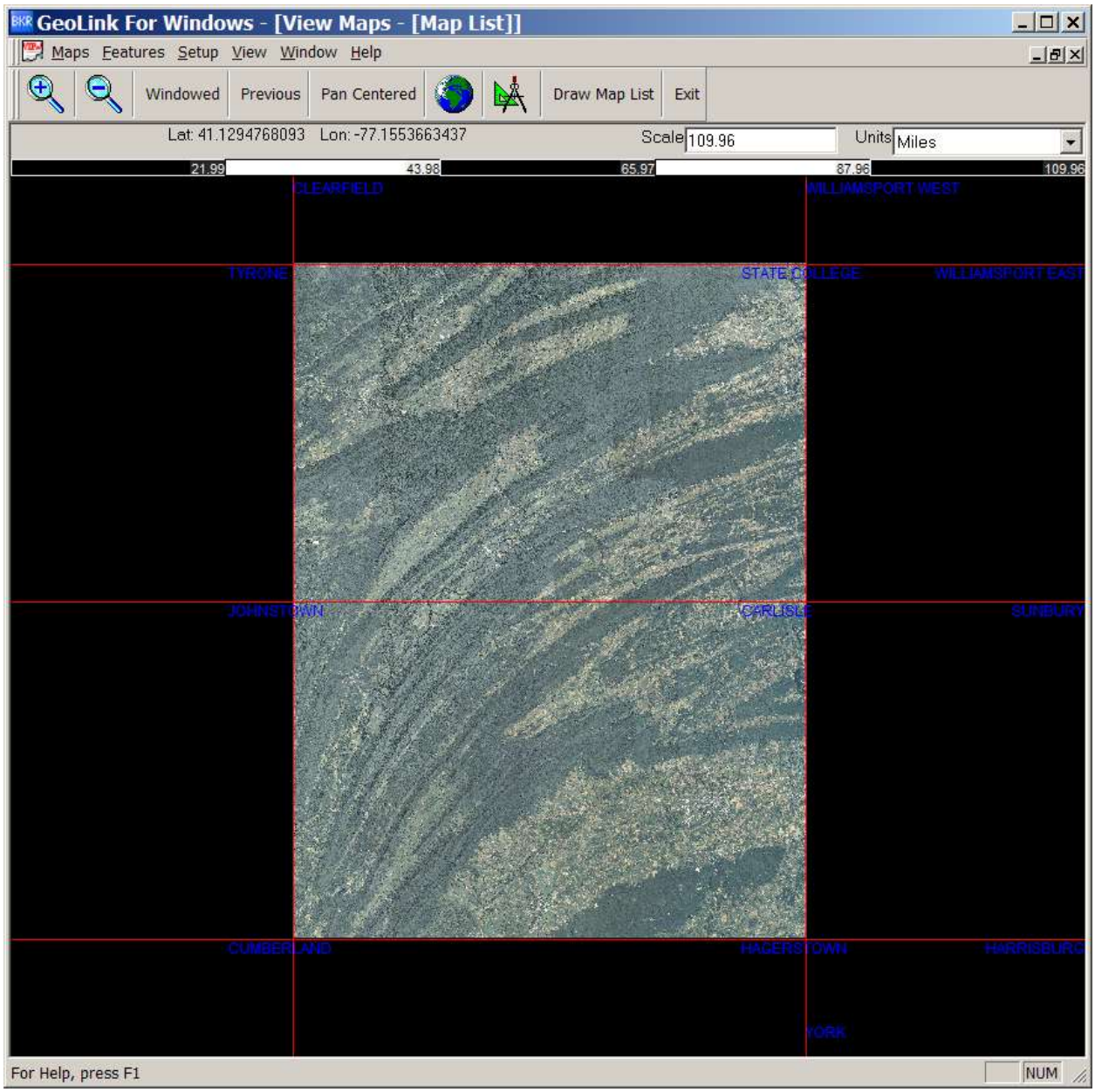


Figure 16. Newly created gor files displayed in GeoLink.

That's it. You have created survey-ready gor image maps from NAIP data.

PROCESSING NOTES

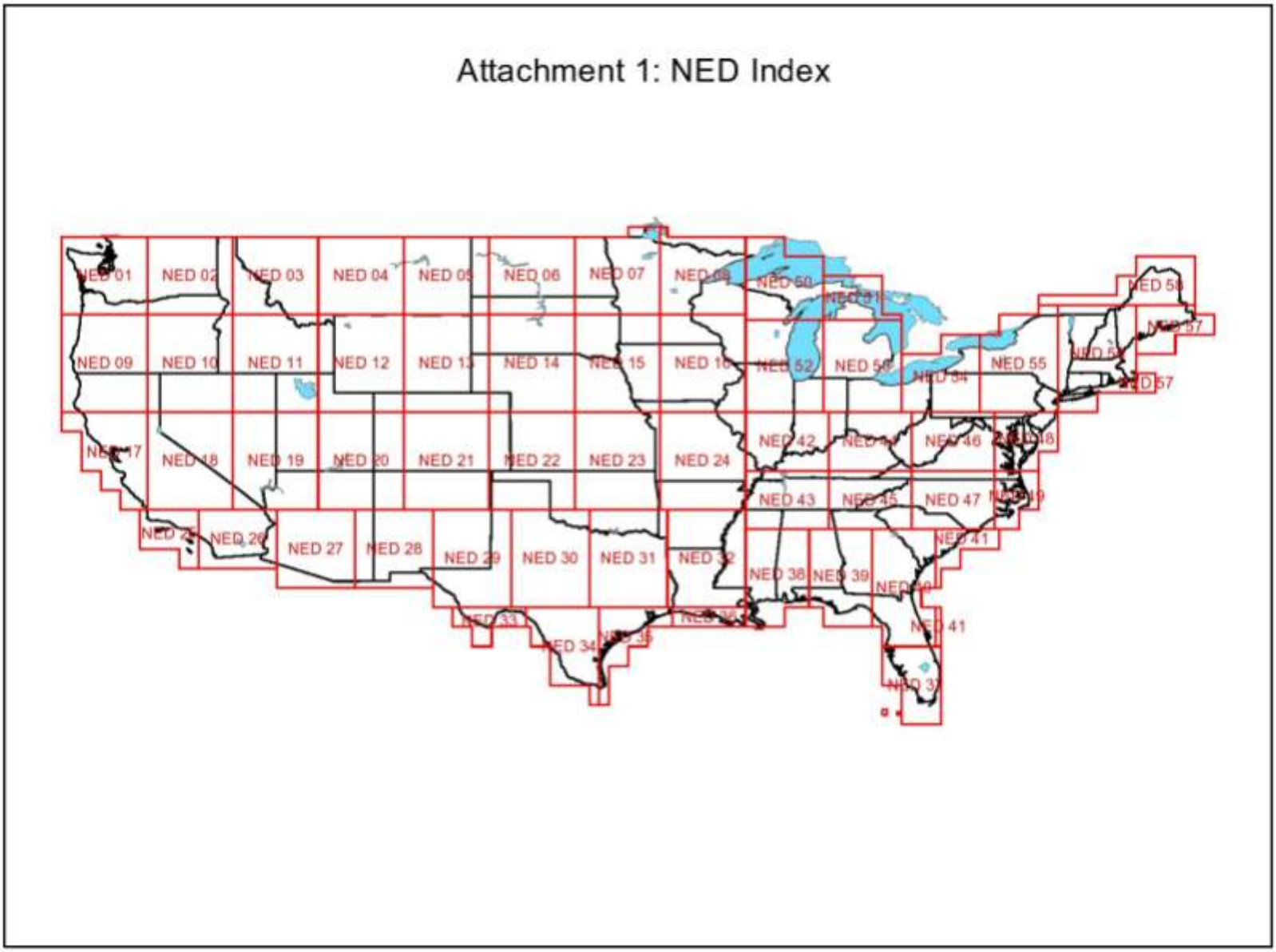
In this example we have created just two quads; typically we process an entire state using these described methods. Processing times can be long and with lots of disk space required so plan accordingly. Some file sizes from this example can be useful in planning disk space requirements:

100 k Quad	ERDAS Imagine (.img)	JFIF JPEG(.jpg)	GeoLink Raster (.gor)
State College	587 MB	55 MB	279 MB
Carlisle	591 MB	51 MB	281 MB

You can also create MrSID files from the img files; these can be handy to use in GIS software. SplitTiff can ingest a number of different raster formats – tiff, MrSID, bmp, etc. We have had the best success using jpg as the input image format as the contrast seems to be better than when using tiff as the input.

Processing performance seems to be better if you are reading from one drive and writing output to another, especially if external USB drives are involved.

ENVIRONMENT

This example was conducted using ArcGIS 9.3.1, ERDAS Imagine 2010, and GeoLink v 6.2.11.15 software on a Dell Intel Pentium Core 2 Duo (3.00 GHz) PC with 4 GB of RAM running Windows XP.

Appendix D. Map for locating NED Tiles