Creating Resource Indexes at APFO

APFO Service Center Support Section
February 2008

Creating Resource Indexes at APFO
Table of Contents

Creating Resource Indexes at APFO
Background

In January 2008, APFO began to question the inclusion of index creation in the contract for Resource imagery projects. The contractors who flew these projects were very often unfamiliar with software, such as ArcGIS, which could be used to easily create these indexes. Creating indexes to provide with the film and prints had become extremely time consuming, and often delayed their delivery for as much as a month.

The Service Center Support Section was asked to create a process for index creation which could be done in house. A part of this test was an estimate of the time needed to make an index, in order to justify removing this step from the contract requirements.

Creating an index would require a center point file and background Digital Raster Graphic (DRG). The DRG is provided by the customer (the forest) and the center point file is provided by the vendor. In addition, the Cartographic Inspection Report generated by the APFO Quality Assurance inspection would be an extremely helpful tool in working with the data. Basic guidelines for the index style were provided by QA and Contracting, in order to create a product which matched the indexes previously provided to the forests.

After working with the index data, and streamlining a process, it was found that an individual map sheet could be completed in several hours. The initial set up would take more time, but after saving a downloaded tool in ArcToolbox, and saving small expressions used in the process, the subsequent sheets could be created much more quickly. A completed index would be passed on to QA for inspections, corrections would be made, and the final version could be sent to the forest and archived at APFO.

As personnel in the National Forests – the end users of the imagery and indexes-become more comfortable with GIS, the need for paper indexes may go away. Some forests already request only the center point file for image location. The possibility of more digital flight projects would also change the format of indexes. It is very possible that this process may not be needed in five or ten years' time.

However, at present most Resource projects are still flown with film cameras, and there is still a need for paper indexes. Until that changes, APFO will be able to create indexes in house in a more timely and cost effective manner than including this in the contract.

Instructions for Resource Index Creation

I.   Geodatabase Creation

All of the files for a given forest will be stored within the same geodatabase. The set of feature class files for each map sheet within a forest will be stored within a distinct dataset.

A feature class of the photo center points will be the primary element used in the index creation. The feature class will be created from a .cvs file supplied by the vendor. The index will use a government furnished DRG as the base.

A. Creating the project

1. Create a folder for the forest. In ArcCatalog, create a new personal geodatabase to contain all files for the project. Inside the geodatabase, create a new feature dataset, which will contain the feature class files for each individual map sheet. Import the government furnished background DRG, with title block, into the geodatabase. If there is no Title Block this will need to be brought in and geo-referenced later in the process.

2. Create a new empty point feature class by copying the *Example* point feature class into the dataset. This file will contain a field for PointTypes, which will contain the subtypes to be used in making the index. An alternative method for this step would be to manually add the point type field and add subtypes after creating the Center Point feature class from the table of points. This method could be used to create a new feature class "template".

The completed setup should look something like this:

B. Populating the point feature class.

1. Open the .cvs file in Excel and save it as an Excel worksheet. In the Lat and Long fields, set the number of decimal places to six.

2. In ArcMap, under the *Tools* menu, select *Add XY Data*. Navigate to the center point file and select it, making sure that the Long and Lat fields are being used for the X and Y fields in the dialog box. Since the coordinates

are in decimal degrees, the Coordinate System will be selected from the Geographic projections, and will be NAD 1983. The coordinate system could also be imported from a pre-existing point feature class. Click OK to add the points into the map view.
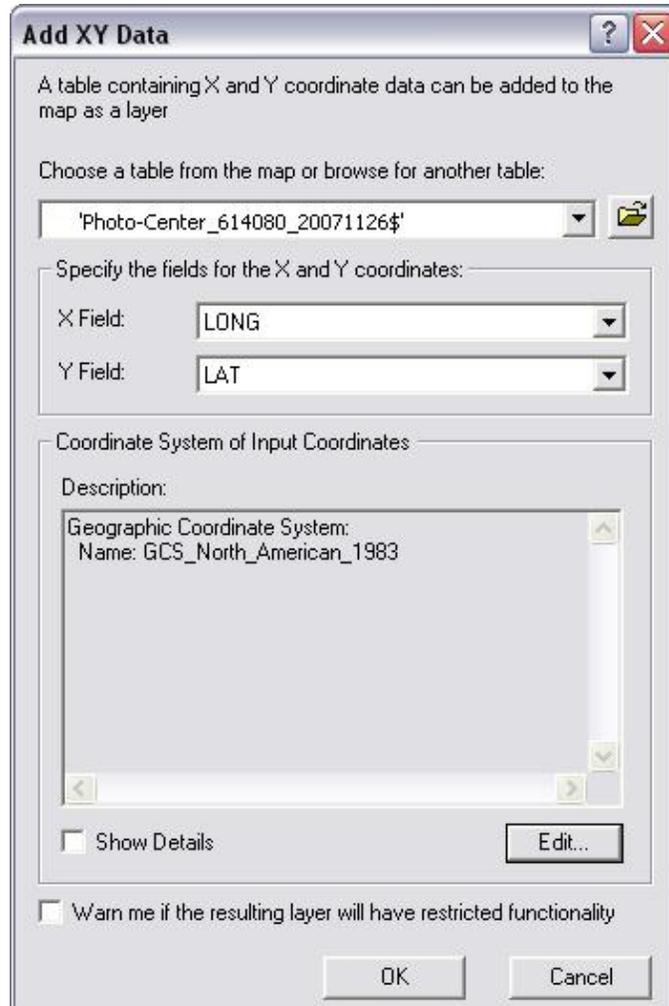
3. The point file event which displays on the screen will need to be exported as a feature class within the personal geodatabase, but not the feature dataset. This will be a preliminary file in the index creation process. Add the file to an ArcMap document, overlaid onto the DRG.

4. In the example shown on the next page, the points for the forest fall on three separate map sheets. The points for the index map being made will need to be selected from the file. This will be done manually with the Select Features tool. Only select points which fall on the map sheet itself. Do not select any points falling within the white area bordering the maps. Points which are on the edge of the map sheet should be selected.
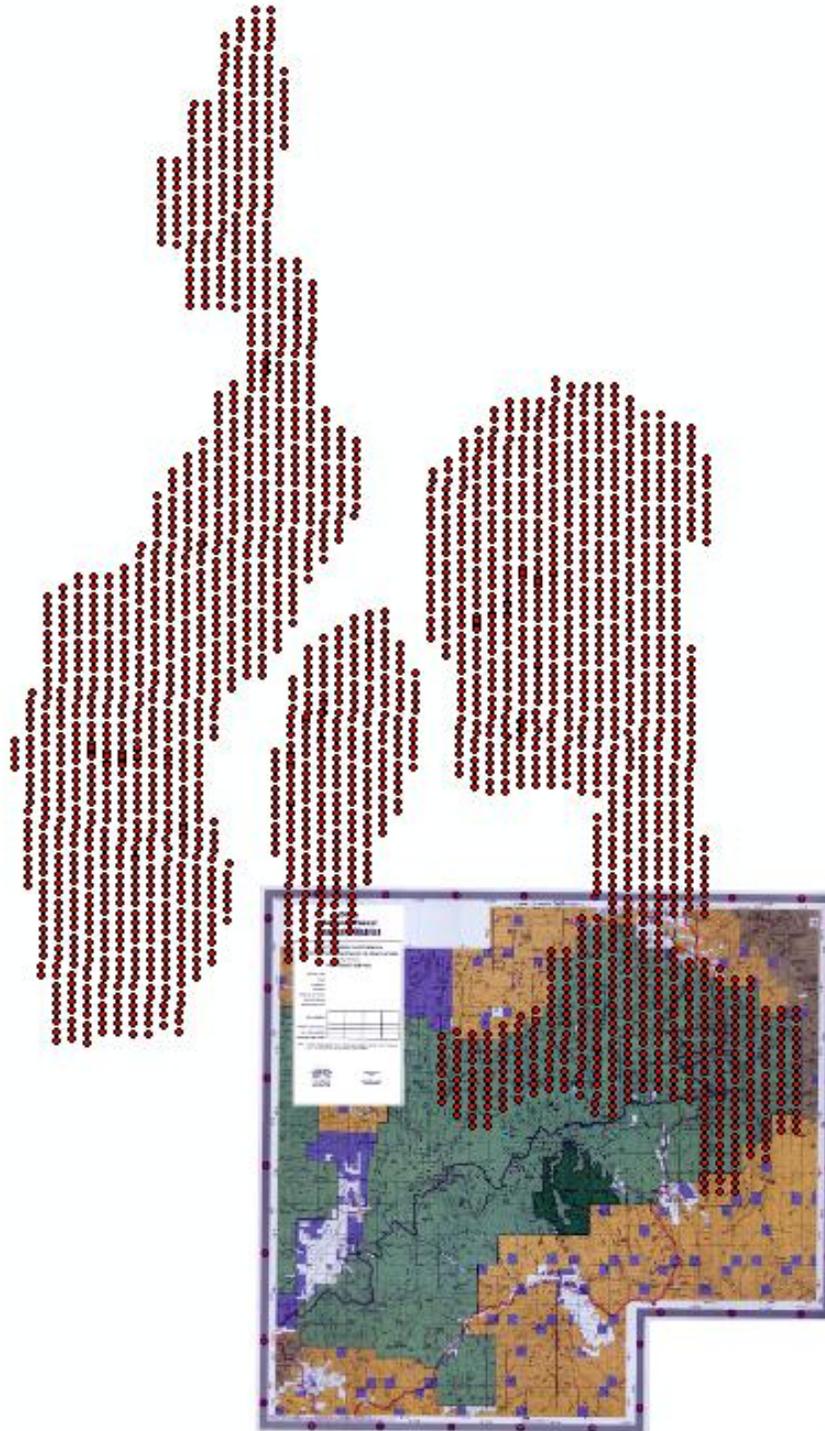
4. After selecting points, create a workable file by right clicking on the selection name in the *Table of Contents*, and selecting *Create Layer from Selected Features*. This layer will then need to be exported as a new feature class.

5. After trimming the selected points to match the map sheet, the data will be added to the feature dataset created for the project. In ArcCatalog, right click on the name of the empty feature class, and select *Load*, then *Load Data*. The *Simple Data Loader* Wizard will open. In the second panel, navigate to the point file just created, which contains the point data to be added. When the path appears in the upper window, click *Add*, and it will be moved to the lower window. Click *Next* to move to the next panel.


6. In the next panel, select *I want to load all features into a subtype* and select *Tic Marks*, which will be the default setting. In the next panel, be sure that each *Target Field* has a *Matching Source Field*, except for the *PointTypes*, which will be empty. In the next panel, load all Source Data, and in the final panel, check over the Summary to make sure that all the information is correct.

7. After the data has been loaded, all of the points should be given the default type *Tic Mark*. This field will be used to set the symbology. Open ArcMap, and add the new point feature class. Right click the file name in the *Table of Contents*, and select *Properties*. Click the *Symbology* Tab, and import (or create) the layer file *PrelimSymbols.lyr*. All point types will be assigned the tic mark symbol except Duplicates, which will be displayed with a red circle.

8. To manually assign symbols, right click a symbol, and select *Properties* from the dialog box which opens. In the *Symbol Property* editor, select *Character Marker Symbol* as the Type, and *ESRI Default Marker* as the Font. Scroll down through the collection of symbols, and select the thinnest crosshair symbol for the tic mark. Assign this symbol to all the subtypes except *Duplicates.* For Duplicate, select a circle symbol and color it red, or some other color which will stand out. If necessary, save the settings as a layer file named *PrelimSymbols.lyr,* or something similar.
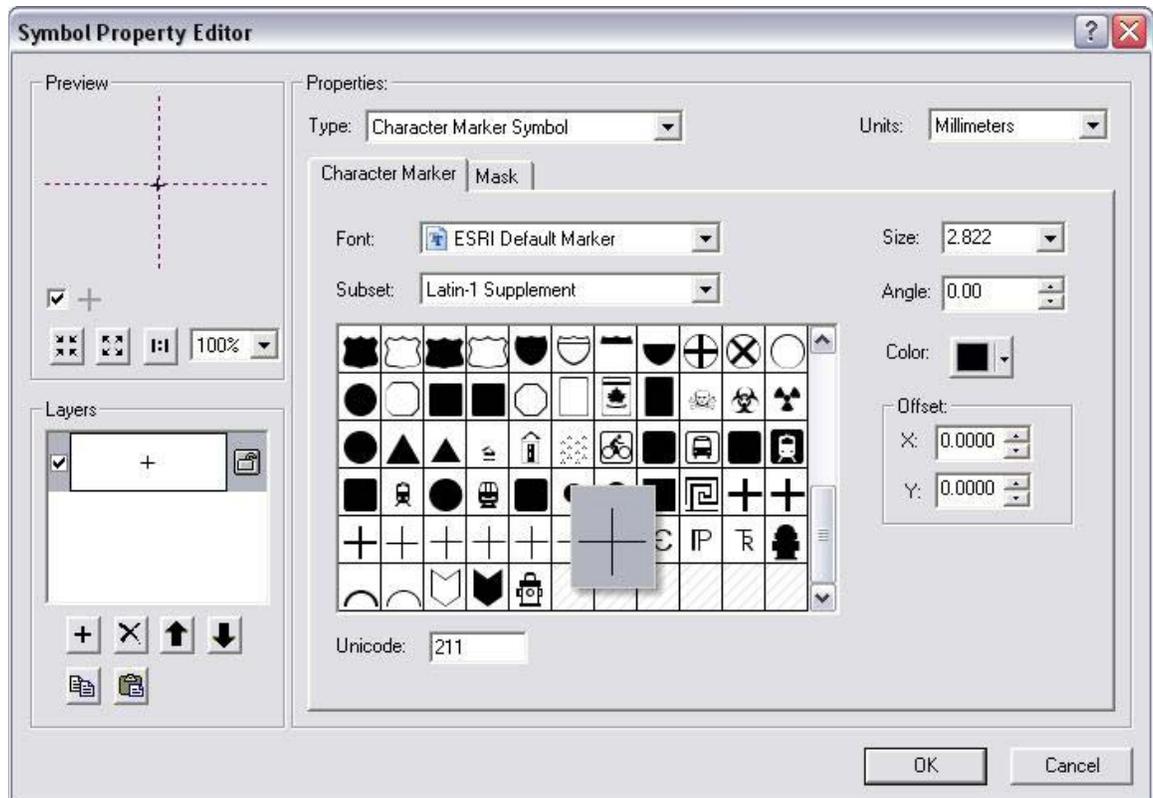
C. Creating a new Point Feature Class

1. An alternative method for creating the point feature class would be to export the point selection for a map sheet directly into the feature dataset of the geodatabase. The subtypes would need to be manually created.

2. In ArcCatalog, navigate to the point file, and open the table in the preview window. Click the *Options* button, and select *Add Field.* Add a *Short Integer* field Called *PointTypes.*

3. In the *Table of Contents* in Arc Catalog, right click on the feature class name and select *Properties.* Click on the *Subtypes* tab. Fill it in so that it is the same as this example. There will be a sixth subtype, South Tic Marks, with code 6, which was cut off in the graphic.
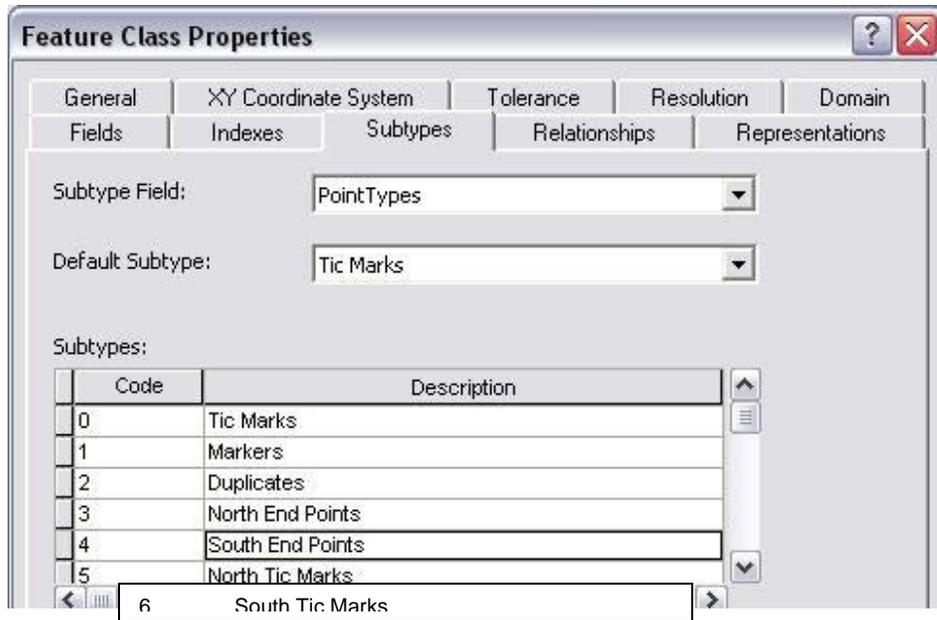
4. Open the point file in ArcMap. The *Subtypes* should be visible under the heading *PointTypes* in the *Table of Contents* on the left of the screen. If necessary, set all of the points to the default attribute, Tic Marks. Apply *PrelimSymbols.lyr* to the file to view the symbology.

5. To create a "template" feature class, copy this feature class file and give it a different name. Delete all the records. When starting on a new project, copy the empty feature class into the dataset with a new name, and load the data into it.

II. Analyzing the Point Data

A. Inspecting the Report

The beginning steps of index creation involve gaining a familiarity with the data in the project. The Cartographic Inspection Report provides a listing of the rolls and exposures which comprise each flight line in the project. Study this report, and mark each flight line with duplicates, noting which positions in the line have more than one exposure. This can be determined from the numbers on the right side under each flight line. These numbers indicate an exposure's position in the line. For example:

Flight Number: 12

607	1 - 6	14-JUL-07	1-6
607	20 – 38	14-JUL-07	6 – 24
607	39 - 47	14-JUL-07	23 – 31
207	64 – 111	14-JUL-07	29 – 91

In flight 12, roll 607, exposures 1 – 6 were used for the first 6 exposure stations in the flight line. Station 6 was repeated with exposure 20 from roll 607. Exposure

stations 23 and 24 were represented by exposures 37 and 38, and then 39 and 40, all on roll 607. Stations 29 – 31 were duplicated; on roll 607, exposures 45, 46, and 47 were stations 29 -31, and on roll 207, exposures 64, 65, and 66 covered the same areas. The first and last exposures of a datum break will be symbolized by a black circle and labeled. In this flight, the stations abeled will be 1, 6, 6, 23, 24, 29, 31 and 91.

 When analyzing the report, develop a system to use when classifying the points to be symbolized and labeled. Remember that in a project with more than one map sheet, not all rolls and exposures will be used in an individual file.

**B. Inspecting the Point File to locate duplicate points**

Duplicate points in the file will indicate areas with flight, or datum, breaks. These may occur because the plane needed to change altitude due to an elevation change in the ground below, or because an area needed to be re-flown. The camera will be turned off until the plane returns to that area, sometimes with a different roll of film. In order to obtain stereo coverage for each segment of the flight line, exposures will overlap – generally, two exposures will be flown twice in each segment, often at differing altitudes. The different segments will often be flown with different rolls of film, possibly on different days, and the exposure numbers will not be consecutive.

To begin the inspection:

1. In ArcMap, add labels to the points showing roll and exposure. Right click the file name, and select *Properties*. Click on the *Labels* Tab. Select *Expression*, and add ROLL to the expression by double clicking on it in the top window. Select EXP, and click *Append*. Add spaces between the quotation marks. Save the expression for later use. The expression should look like this example:
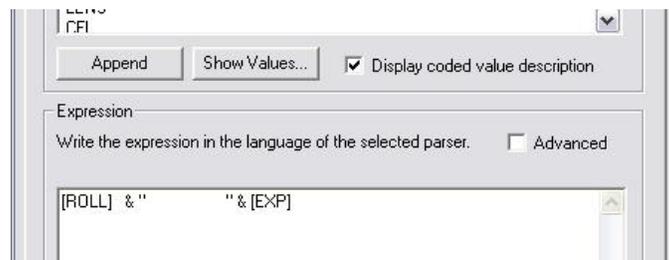

2. In the main label screen, click *Placement Properties*. Select the option to *Place the label on the point*. Under the *Conflict Detection* tab, click the option to *place overlapping labels*. (This can be turned off later if it is too confusing).
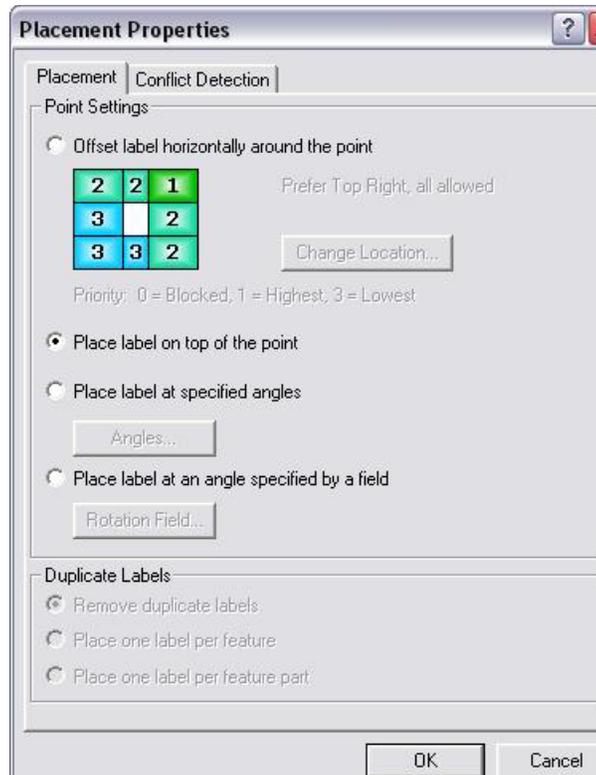
3. The labels should appear with the ROLL to the left of the tic mark, and the EXPosure to the right. The exposures with duplicate points should be clearly visible from the overlapping (or closely spaced) tic marks and labels. They can be seen in the example below.
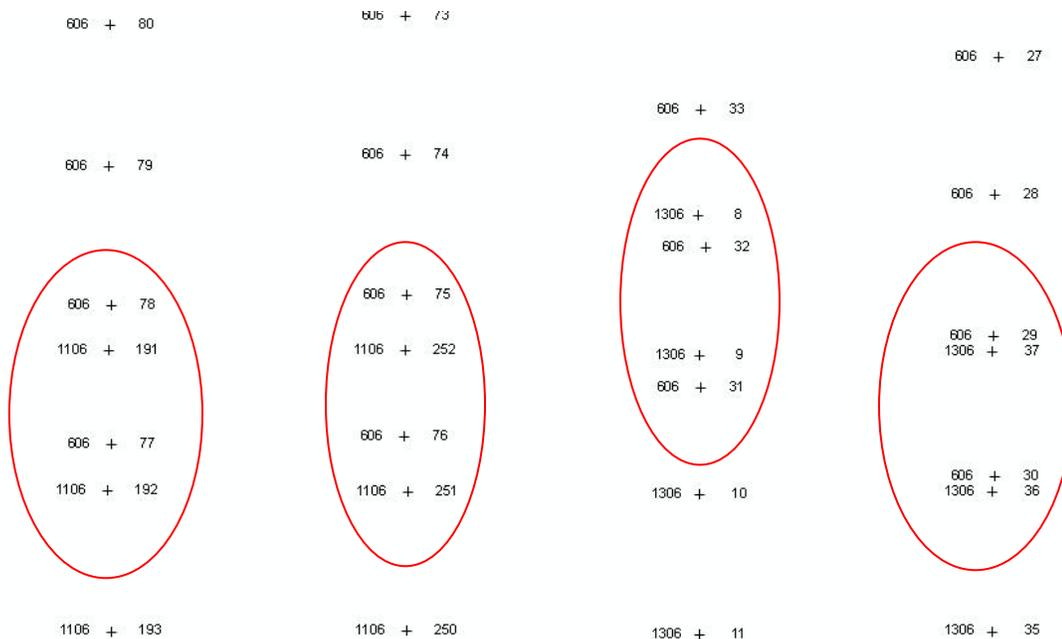
4. The presence of duplicates can also be checked in the attribute edit screen. In the example below, two points (with overlaps) were selected, but four points are displayed in the attributes box. Select duplicate points and change the point type to Duplicates. They will then appear on the screen with a red circle instead of a tic mark. (Remember to select them only if they are the beginning or end of a flight line or if they are the beginning or end points of a gap in EXP numbers.)
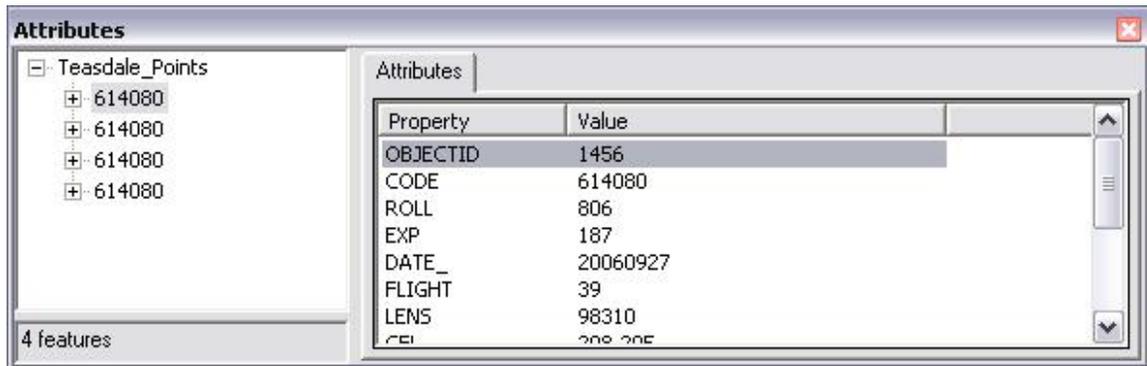
5. As a final check, compare the Cartographic Inspection Report to the symbology and labels displaying on the screen. Correct any errors.

After the points have been inspected and duplicates attributed, the display will look something like this example:
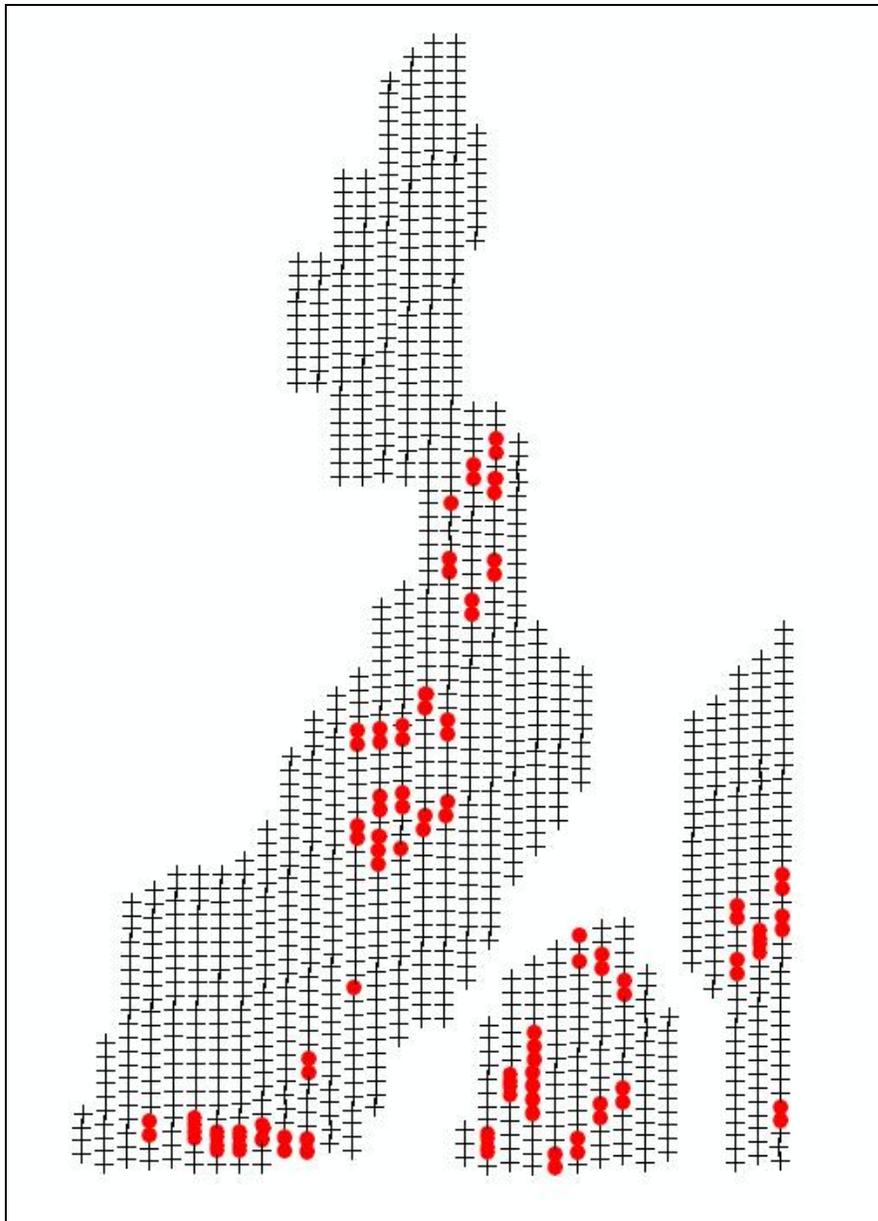
III. Creating Line Features from the Photo Center Point File

This step will use a script available from the ESRI website. It will need to be downloaded and installed once, and then can be used for all subsequent projects. The URL for the site is http://arcscripts.esri.com. Search on convert points to lines, and download *Convert locations to paths* (points to lines) for ArcGIS 9.2 by Tony Palmer. The screen will look like this:

Search ArcScripts

Use the following options to customize your search:

All languages

All ESRI software

10 ☑ Results per page ☐ Show script summaries

Search for convert AND points ANI [search] **Tips**

Refine Your Search

- Add/remove keywords from the search string
- Add software versions to the search string
- Add the author's name to the search string
- Consult our search help

Scripts for: All languages AND All ESRI software AND convert AND points AND lines

scripts **1-10** of **16**

| Resort by Title	Software	Language	Author	Modified	Downloads
An Improvement of TIN for RAS user	ArcView GIS	Avenue	Nan Shi	Jul 1 1999	1753
Convert annotation to lines and maintain text as attribute	ArcInfo Workstation	AML	Nick Harrison	Apr 9 2002	1345
Convert Any Shape 2 points	ArcView GIS	Avenue	Lyes MOKRAOUI	Jun 19 2001	7257
Convert Graphics to Features	ArcGIS Desktop	Visual Basic	Richard Daniels	Jan 8 2008	1585
Convert locations to paths (points to lines) for ArcGIS 9.1	ArcGIS Desktop	Python	Tony Palmer	Dec 13 2006	1167
Convert locations to paths (points to lines) for ArcGIS 9.2	ArcGIS Desktop	Python	Tony Palmer	Dec 13 2006	922
Graphic Grid Maker version 5	ArcView GIS	Avenue	Taro Narahashi	Mar 24 2007	2791
KML 2 SHP Converter for points, lines and polygons	ArcView GIS	Avenue	Antonio Almeida	Mar 18 2007	2852
NodePoint - convert nodes to points in new shapefile	ArcView GIS	Avenue	Stephen Lead	Mar 5 2004	3071
Point & Polyline Tools v1.2	ArcView GIS	Avenue	Soeren Alsleben	Jan 10 2002	19745

1. Download and unzip to a desired location. In ArcMap, click the red toolbox button on the standard toolbar to open the toolbox window, if it is not already open. In the white area of this window right click and select *Add Toolbox*. Navigate to the folder containing the Path Builder Tool. Select it, and hit *Open*.
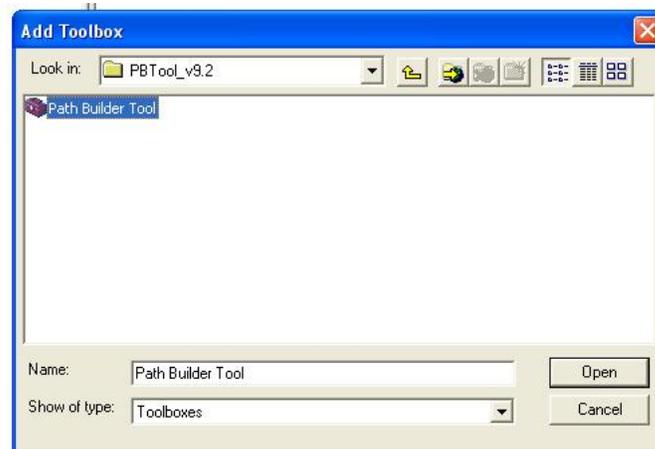
2. Right click *Convert Locations to Paths*, go to *Properties* and select the *Source* tab. Click the folder button next to the path and navigate to the *Pathbuilder.py* file. (It will be in the same folder as the toolbox). Click *Open,* and *OK* when finished.
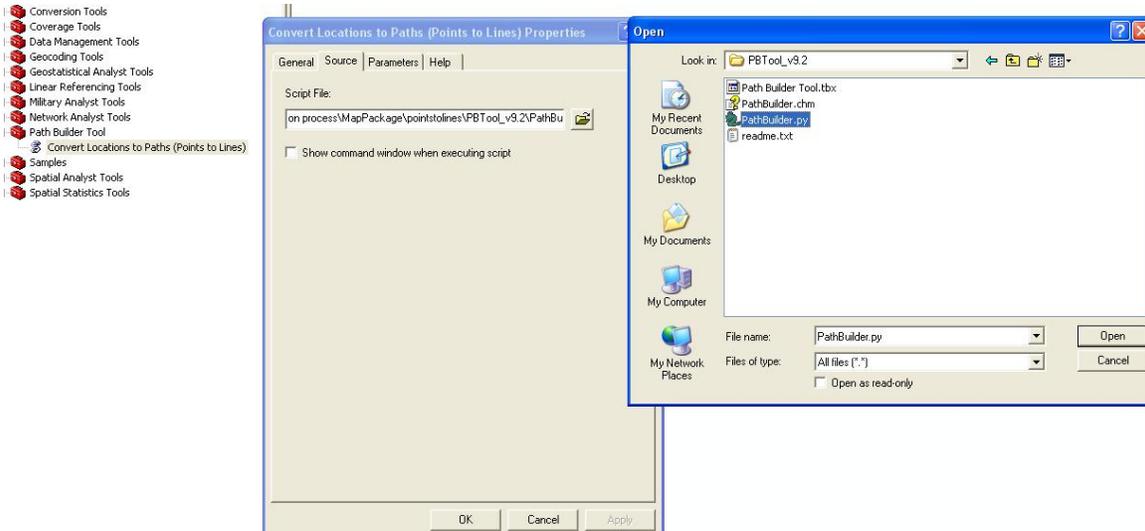

3. Now double click on the *Convert Location to Paths* tool to open it.
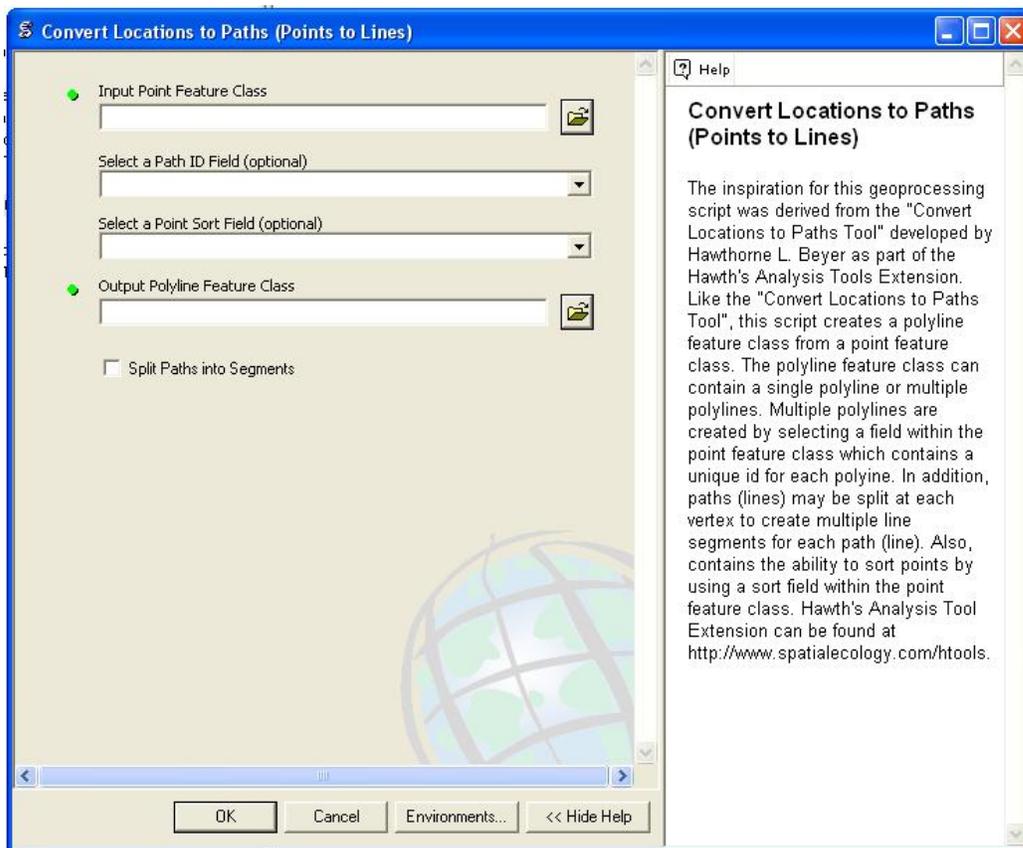
4. Select the point feature class to be converted in the *Input Point Feature Class* box. Select the *Flight* field for the Path ID Field box. Leave the *Point Sort Field* blank. Select an appropriate location and name for the output flight lines shapefile. Save the line file as a shapefile by typing .shp after the name, and save it in a location outside of the geodatabase.
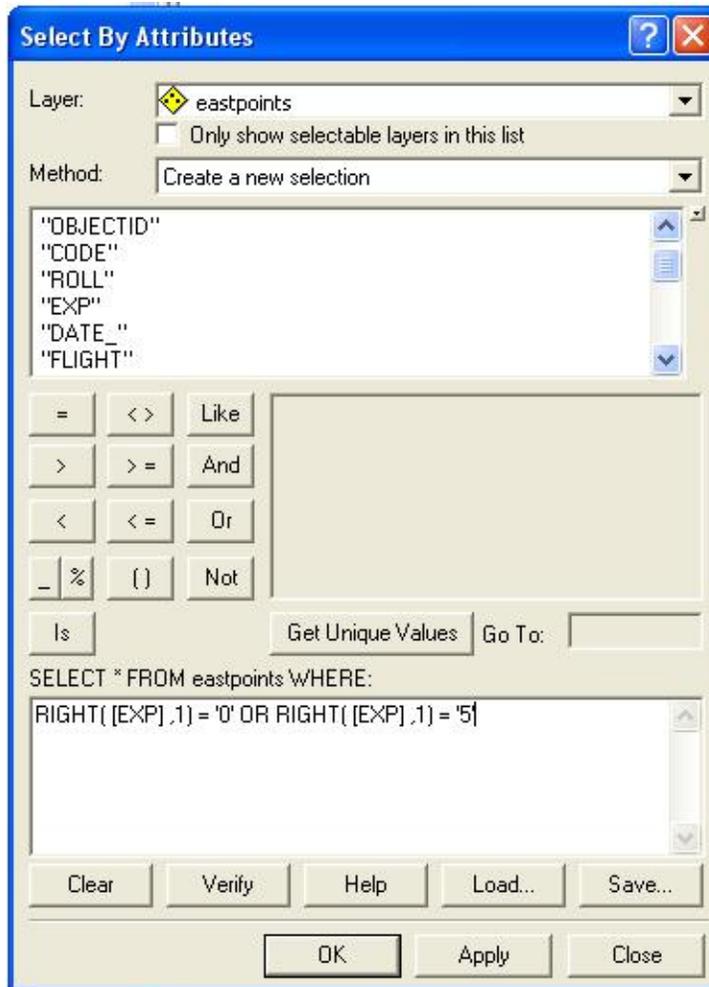
5. Check the flight line output shapefile for errors. Manually pan around the data view to make sure there are no gaps or horizontal lines. If there are, start an edit session and fix the errors either by adding features or by deleting them. Flight lines with re-flights (datum breaks) will display two overlapping lines. These could be erased and re-drawn as one line. It is not necessary to draw or label each line segment. Remember to edit the attribute table with the flight line number as needed.

6. Manually extend the flight line to the end of the map sheet for flight lines which are continued onto another sheet. The next point in the flight line would fall on the "white area" of the map sheet.

Manually drawn lines
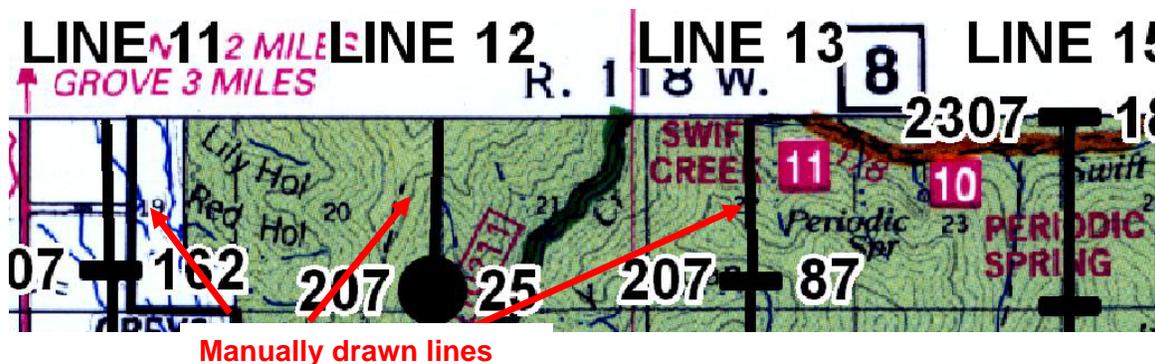
IV. Select all Points with an EXPosure Field ending in 0 or 5, and Classify them as Markers

1. Open the *Select by Attributes* menu.

2. Make sure the *Layer* box is set to the working points feature class, then enter this syntax statement into the box : RIGHT([EXP] ,1) = '0' OR RIGHT([EXP] ,1) = '5' AND "PointTypes" <> 2. This will ensure that all exposure numbers which are multiples of five will be selected, except those which are already duplicates. Save the selection expression to use in other projects.

Select By Attributes

Layer: eastpoints

☐ Only show selectable layers in this list

Method: Create a new selection

```
"OBJECTID"
"CODE"
"ROLL"
"EXP"
"DATE_"
"FLIGHT"
```

=	< >	Like
>	> =	And
<	< =	Or
_ %	{ }	Not

Is   Get Unique Values   Go To:

SELECT * FROM eastpoints WHERE:

RIGHT([EXP] ,1) = '0' OR RIGHT([EXP] ,1) = '5|

Clear   Verify   Help   Load...   Save...

OK   Apply   Close

3. Classify each selected point with the *Markers* description from the pull down menu of subtypes.

V. Setting Duplicates and End Points

A. Duplicates

Return to each of the areas which were identified as *Duplicates* earlier in the process. Any points which are beginning or end points of a line segment (datum break) should retain the *Duplicates* classification. All others should be changed to *Tic Marks* EXCEPT those with exposure numbers which are multiples of 5. These should be classified as Markers. Check carefully with the Cartographic Inspection Report to be sure that these are attributed correctly.

B. End Points

The first and last points of each flight line on the map sheet will be labeled with the roll and exposure numbers as well as the Flight Line number. The points will

fall into one of four categories: End Points, North and South, which are the terminal exposures of the flight line, and Tic Marks, North and South, which will designate points which are part of a line continuing on to another map sheet.

In addition, end tic marks which are also multiples of five (Markers) should be changed to North or South End Points. This designation will take priority over the "markers" designation because the flight line label and position will also be based on the attributes for the end points.

Pan around the top and bottom of the map sheet and manually select endpoints (in groups as much as possible) according to their classification. On the north side there will be North End Points and North Tic Marks, and on the south side there will be South End Points and South Tic Marks.

Do a quick visual scan of all the points to make sure that all end points, duplicates, and multiples of 5 have been attributed correctly. If they have not been, manually select and classify them.

VI. Setting Symbology

1. Right click the point feature class in the table of contents and select *Properties.* Move to the *Symbology* tab.

2. Click *Categories* and *Unique Values.* Make sure *PointTypes* is selected in the *Value* Field. Then hit *Add All Values.* Uncheck the first entry, *(all other values).* The example below is a completed symbol set.
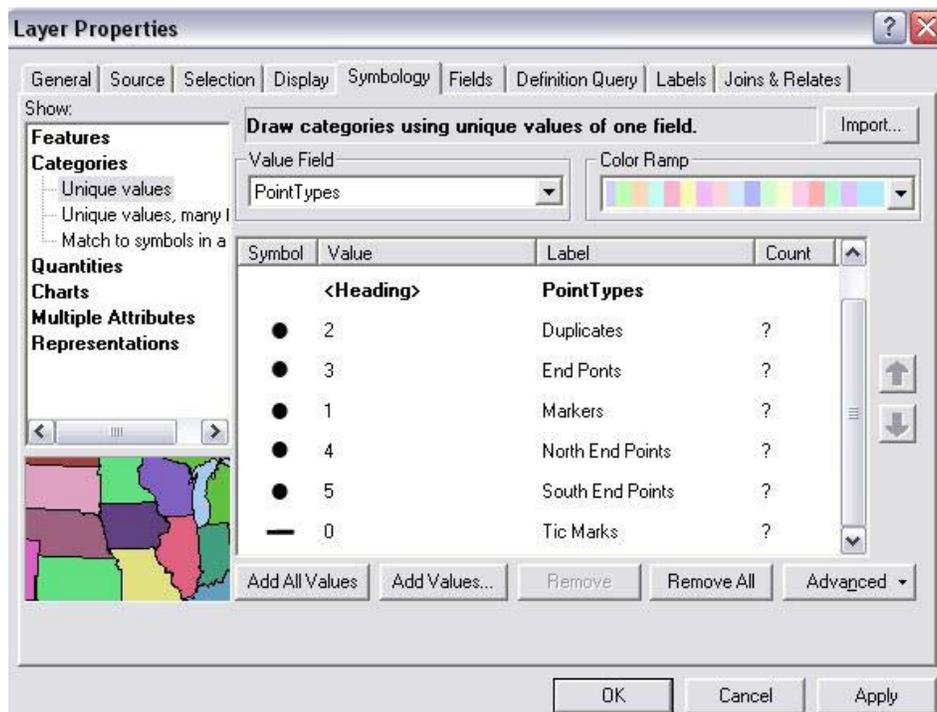
3. To set the circle mark, double click the point symbol for *Duplicates*, and select Circle 1. Set it to size 18 and color black. Save the circle as a style with a name like Resource, and apply it to the Markers and End Points as well as Duplicates.
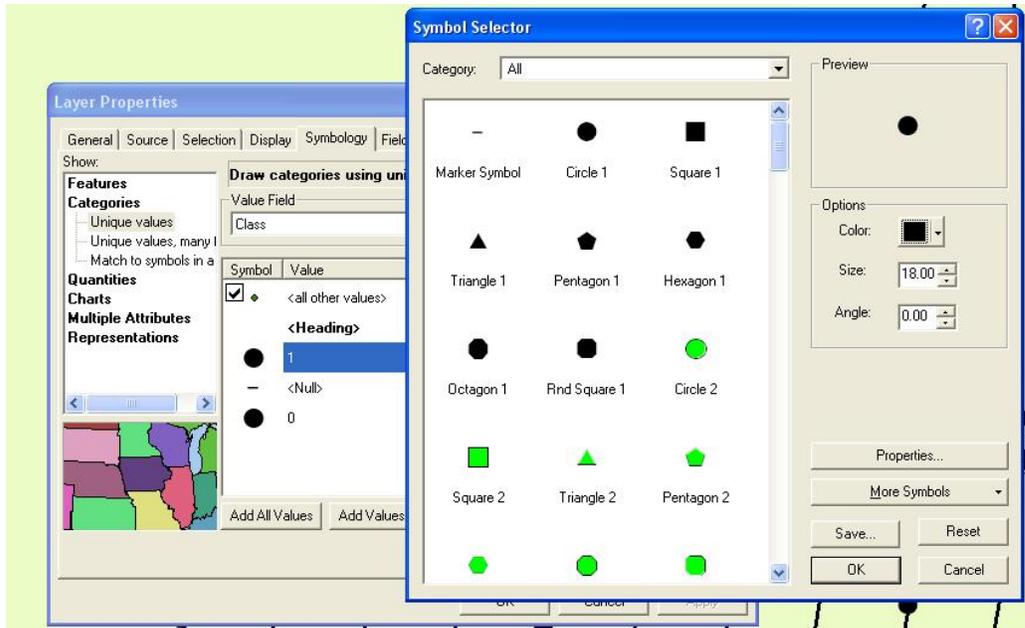
4. To set the Tic Marks, double click the point symbol. Click the properties tab, change the Type to Character Marker Symbol, change font to ESRI Dimensioning, and select the 45 degree angle dash shown below. Change size to 18 and set angle to -45. Save this as a style to be selected in future projects.
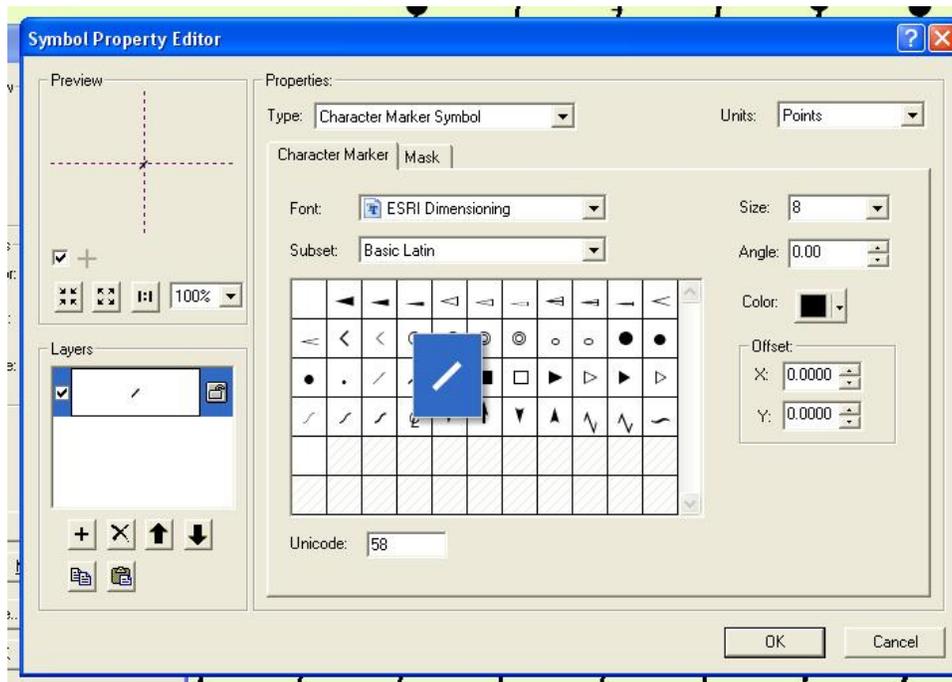
6. Make the flight lines black by double clicking the symbol in the Table of Contents. Give the line a thickness of 2.

7. Save the project as a Layer so that the Symbology may be applied to other projects

VII. Label the Rolls and Exposures

1. Add the label toolbar to the document.

2. On the label toolbar, under *Labeling*, turn on the *Maplex* label engine.
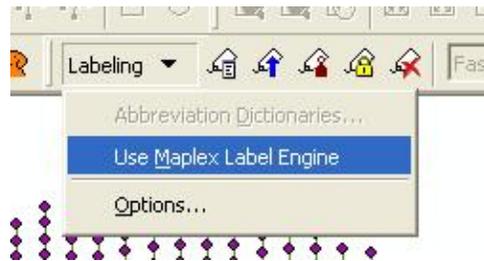
3. On the label toolbar make sure the drop down box says *Best* instead of *Fast*.

4. Open the label manager by clicking the white tag and box icon next to the labeling menu on the label toolbar. Check the box next to the point feature class under Label Classes, and the lower right box gives the option to create labels from symbology categories. Select Duplicates, Markers, North End Points and South End Points, and click Add. Say yes to overwrite the defaults. The classes will be added to the window on the left, as shown below.
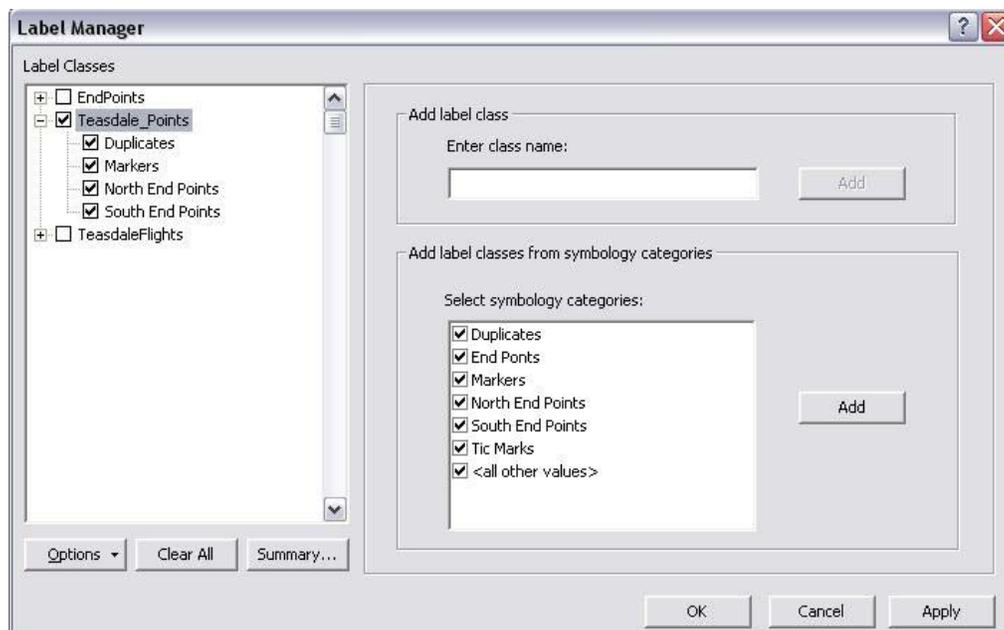
5. Create the label style to be used for all points except duplicates. The Roll number will be to the left of the point, and the Exposure number will be to the right. Set the *Label Field* to ROLL, and set the *Position* (under *Placement Properties*) to Center. Click the *Expression* button, and add the expression box "[ROLL] & "   " & [EXP]", as shown in the example below. Hit *OK* and *Apply* in the label manager box.

 Save this expression so that it can be used for other classifications, and in other projects. Click the *Save* button, and assign it a name. For the other label classifications, click *Load*, and select the saved expression.
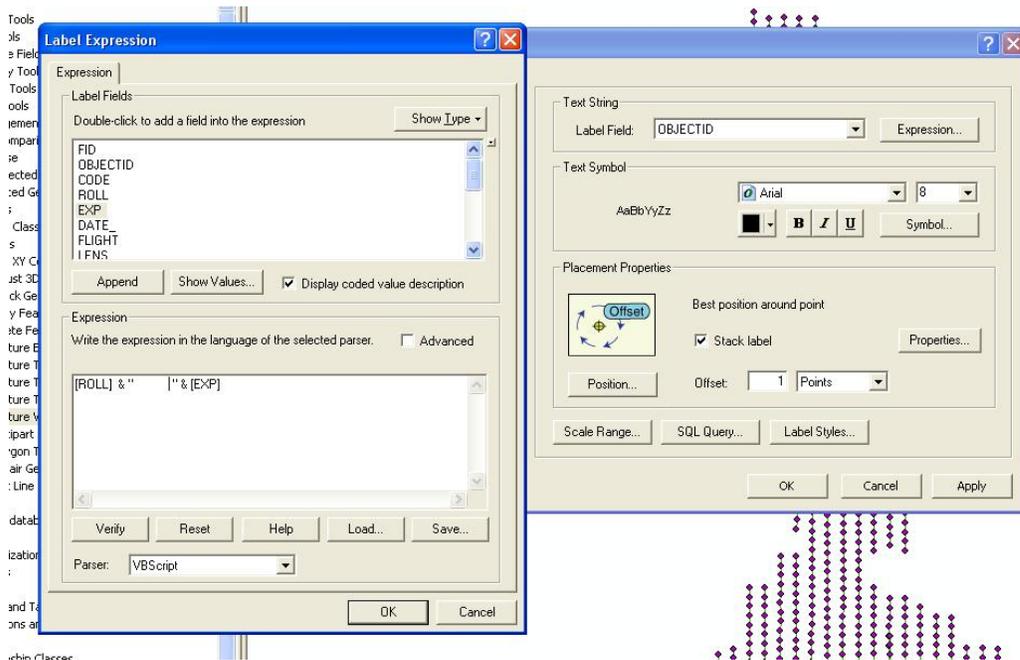
6. An alternate expression is given below. Use this if the spacing between ROLL and EXP will not display as selected. The number given is a percentage of the word width, and can be adjusted as needed. Save this expression for reuse. 450 may space the labels too far apart. Try 400 or 350 instead.
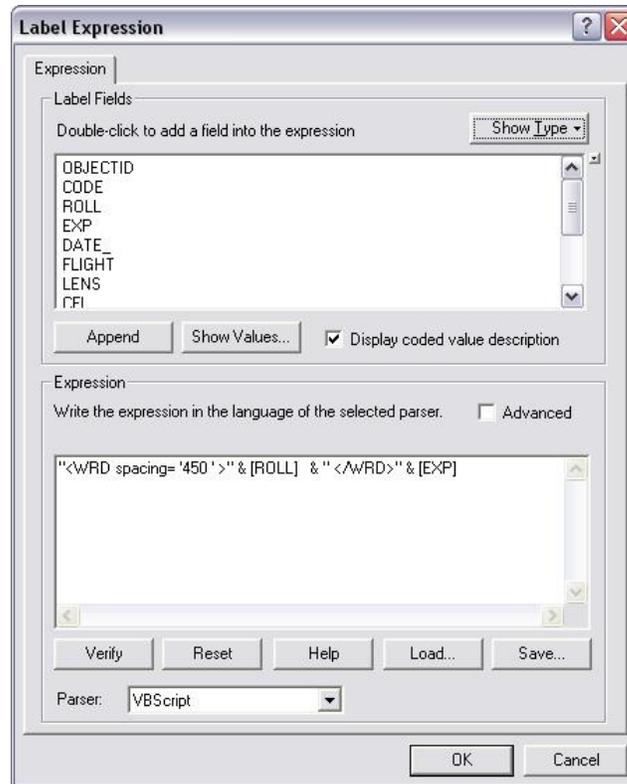
7. Create all labels as Arial, 10 points, Bold. Hit the *Symbol* button for the Marker label class; select *Properties* and then go to the mask tab and check the halo radio button and give it a size of 1. Make the text Bold before hitting *Apply* on the label manager menu. Repeat this step for the End Point labels.
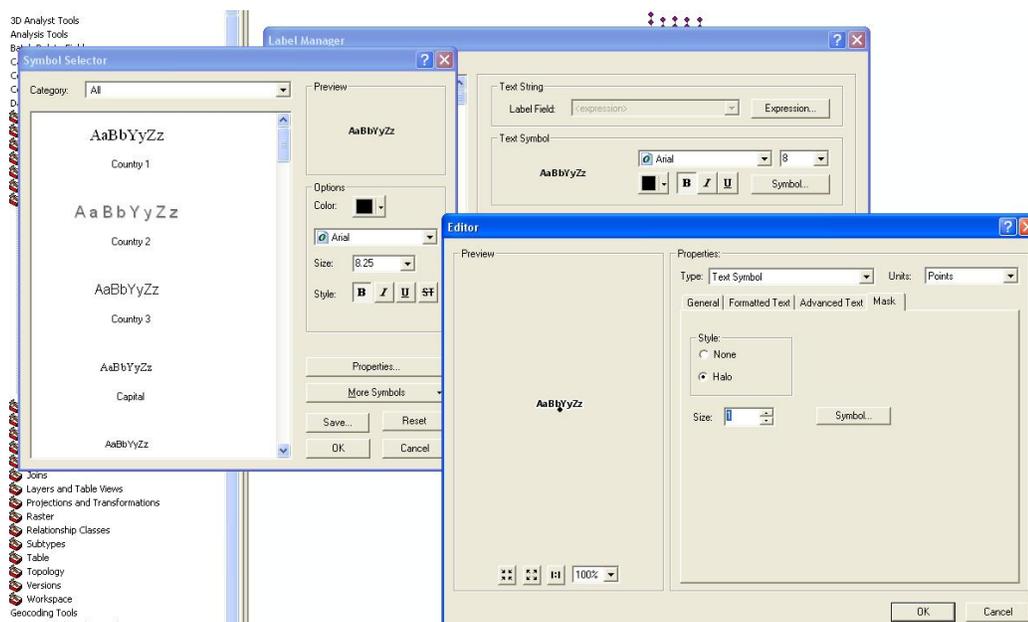
8. The *Duplicates* labels will have a different setup. They will display with the ROLL and EXP stacked, one above the other, and with one label on each side of the duplicate points. In the Label Manager, place the label to the side of the point (Horizontal and West – or East), and check *Stack Label*.
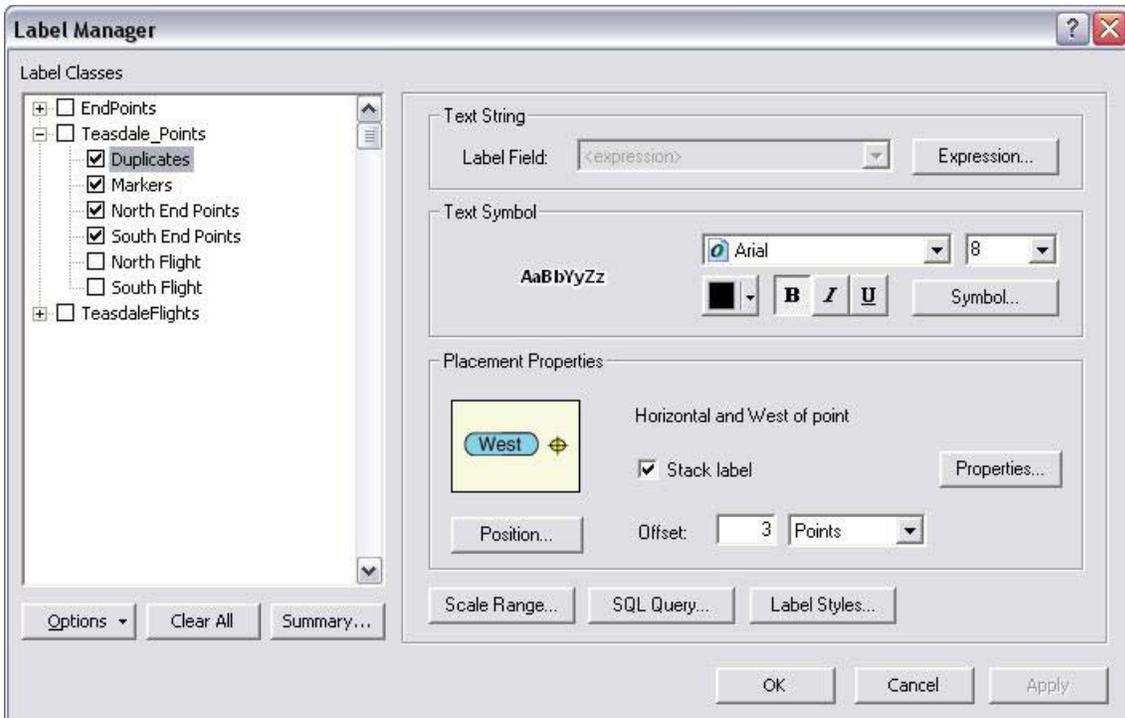
9.   Add the following Expression after clicking the Expression button. Save it with the name *Duplicates* for future use. Being it into the box by clicking *Load*.
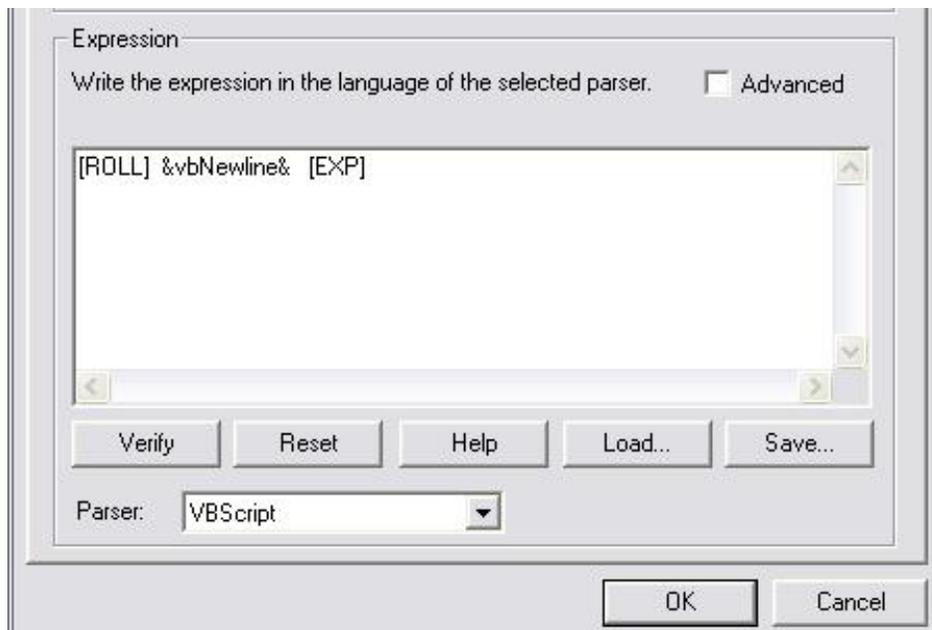
10. Click the *Properties* button, and select *Conflict Resolution.* Check next to *Never Remove Label.* The duplicate labels will be placed on top of each other, and will be moved to their correct positions after being converted to Annotation.

12. Create two more label classes within the PointTypes field for the Flight Line feature class, calling them North Flight and South Flight. Perform step 8 again for both of these classes. Make sure *Flight* is selected as the label field. Click the expression box and enter: "Line   " & before the [Flight]. Then select the position box and check either north or south depending upon label class.
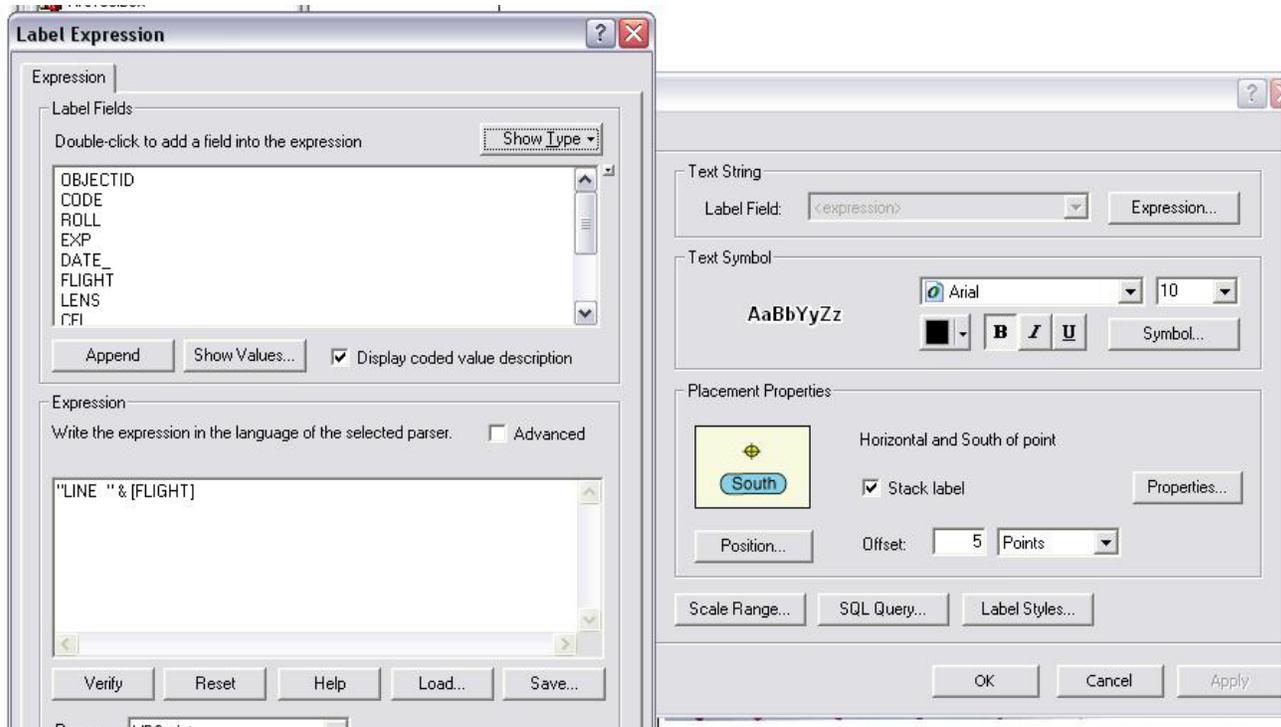
The ends of the flight lines should look like the example below.

FLIGHT 22

106 ● 215
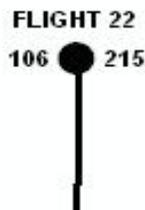
13.   Visually check the labels, especially the duplicate labels. Be sure that only the end points of a datum break are labeled as Duplicate. If both points need to be labeled, there should be two points on top of each other.

14. Hit the SQL Query button on the label manager on the Marker label class. Double click *PointTypes*, add an *equals* sign, and then click *Get Unique Values*. Select the integer code and description that corresponds to the Marker classification. Repeat this step for the other label classes, putting the corresponding code to each class. The North and South End Points will be used for two different labels apiece.
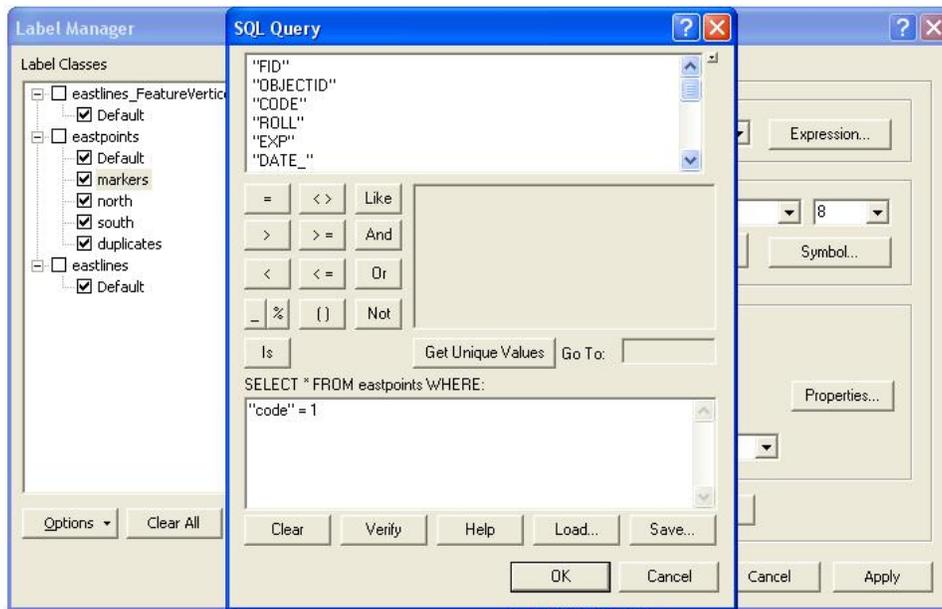
15. Set the scale of the project to 1:126,750, and re-check the labels. Then right click the points feature class and click *Convert Labels to Annotation.*
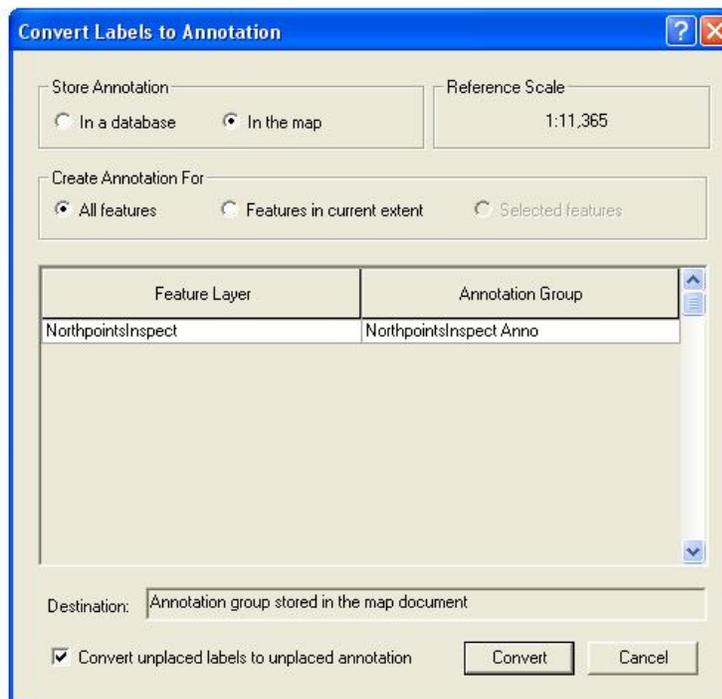
Make sure that *Store Annotatio*n is set to *In the map* and then click *Convert.* In the *Edit* dropdown menu, click *Select all Elements.* Right click one of the selected labels and open the *Properties* box. Under the *Text* tab, select the icon to center justify the text.

Manually select the duplicate labels which need to be moved, and drag them to a preferred spot. Keep the same roll numbers on each side of the flight line; continue the roll sequence from the northern roll on the left side of the line. (In the example below, the points to the north of this pair would have been from roll, 1306, while those continuing to the south would be from roll 1206.)
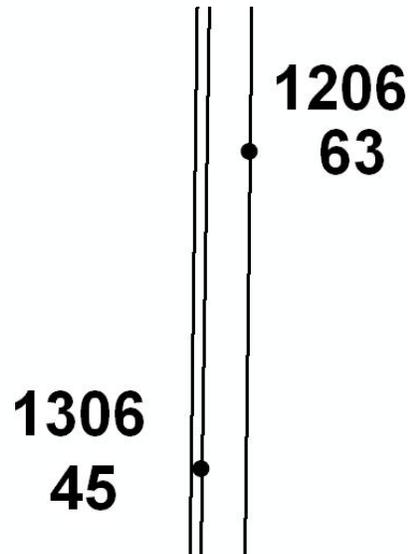
Manually select the Flight line numbers at the top or bottom of the map sheet and align them horizontally (Middle Center) in the white area, without obscuring the preexisting text (as much as possible).

VIII. Georeferencing, Map Scale, and Text

1. Georeference the title block if the supplied DRG did not already have a title block attached.

2. Go to *Tools, Options, Raster Tab, General Tab* and make sure that *"Use world file to define coordinates"* is unchecked before georeferencing.

3. To Georeference the title block, open the georeferencing toolbar. Add the title block tiff to the ArcMap document. Make sure that the title block is listed in the *Layer* Box of the georeferencing toolbar. Zoom in to the area where you would like to put the title block, then under the georeferencing menu click *Fit To Display*. If everything looks good, go ahead and click update georeferencing under the Georeferencing menu. If it needs to be moved or stretched some, click the line with the blue and red crosses button. Now click first on the title block and then the location where you want the point of the title block to be. Do this as many times as required and then update the georeferencing.

4. Go to the layout view and make sure the scale is set to 1:126,750 and that the entire map is visible in the view. It will probably be necessary to change the page size; under the *File* menu, click *Page and Print Setup,* and adjust the size until the map fits in the window at the scale above. Under *Map Page Size*, uncheck *Use Printer Paper Setting*; when the box changes, select *Custom* under *Standard Sizes*, and change the width and height to accommodate the map.
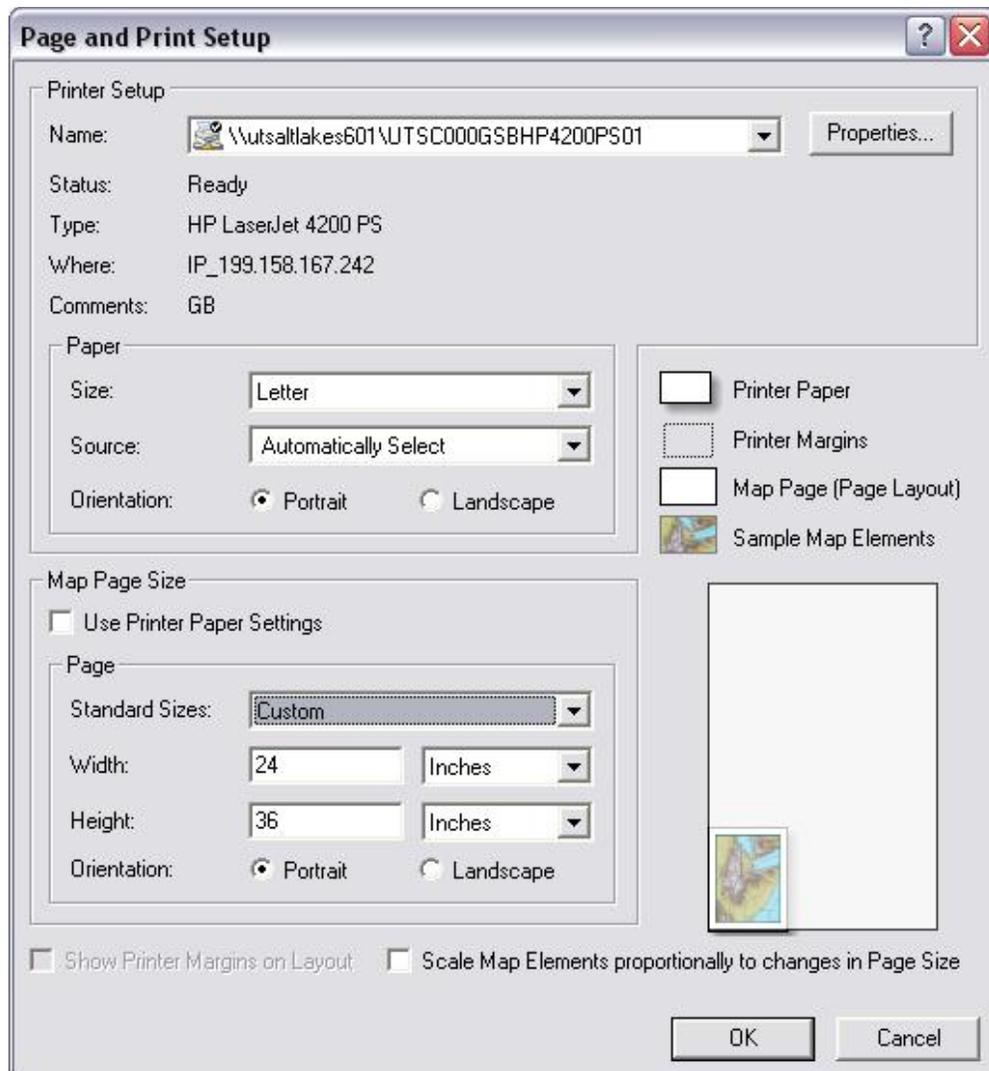
5. Fill in the Title Block using the text button on the drawing toolbar at the bottom of ArcMap. Make sure all the text is the appropriate size etc (10pt Aerial).

6. Export the map as a tiff, and set the dpi to 300. There is not a required dpi setting but this should be a good place to start. In general, the exported map to should fit on a CD and not be too pixelized.

7. Load the exported tiff back into ArcMap and check its quality. Be sure that the "*Use world file to define coordinates*" is unchecked. The new tiff image will also need to be georeferenced. Follow the steps in #2 and #3 to do this with exception. Match the corners, points etc of the tiff to the exact locations of the point feature classes. 6-10 points should suffice. Then instead of *Update Georeferencing* click *Rectify.*
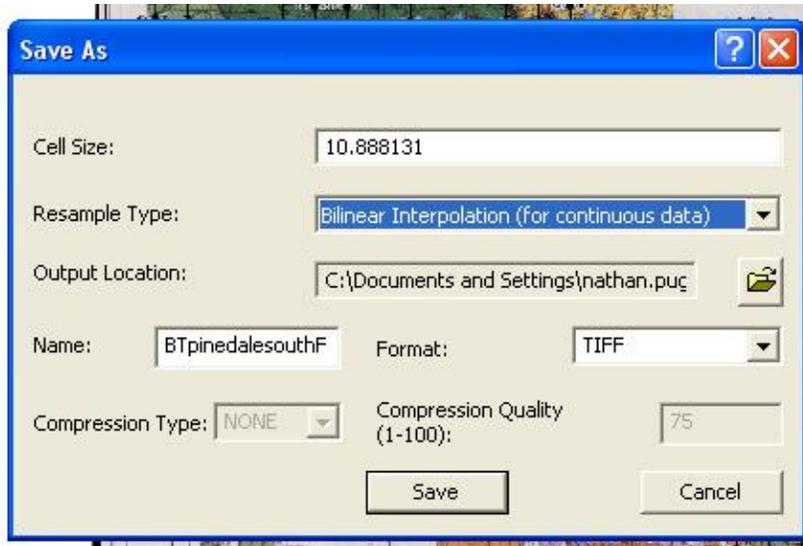
Make sure that *TIFF* is selected as the format and Resample Type is *Bilinear Interpolation.*   Click Save to create the finished Index.

The example below shows the georeferencing tool in action.

28
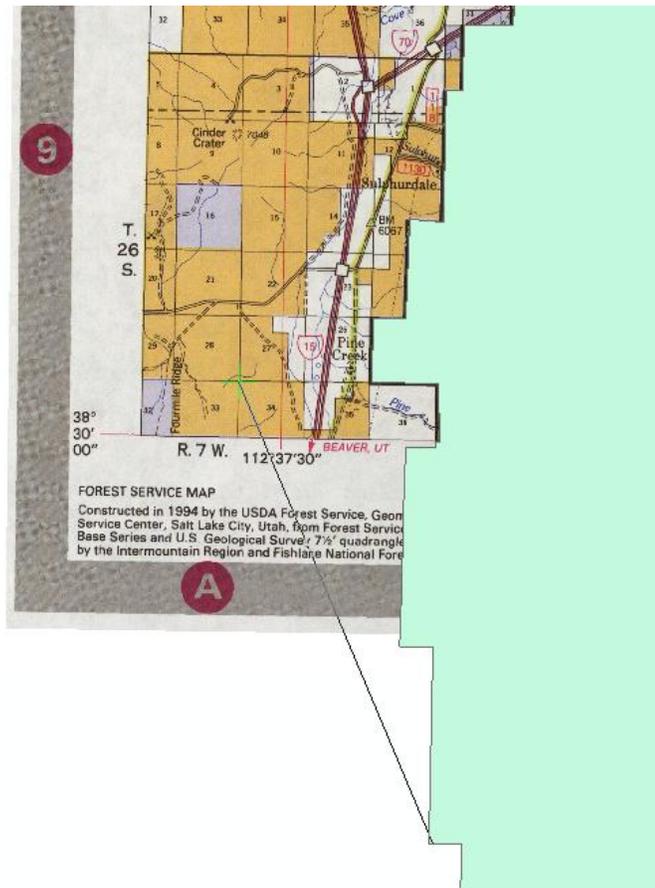
IX. Metadata

An FGDC compliant metadata file will need to be made for each map sheet. It will need to include the following elements, as listed in the Resource contract:

Contractor shall include a metadata file containing, at a minimum, the following data:

Project Name (Name as appears in Section B)
Nominal Photo Scale
Nominal Lens Focal Length
Film Type (CN, CIRP, B&W, etc.)
Number of Film Rolls
Coordinate System Datum
Coordinate Data Collection Method (GPS, Digitizing, etc.)
Estimated Accuracy of Coordinates (Within Meters or Feet)
Date ASCII Exposure Data File was created (MMDDYYYY)

Example:
Payette NF, ID   1:15,840   210mm   CN   9   NAD83   GPS   30m 08162007

X. Archiving

Make two copies of a CD containing the Index and metadata file. Create a template for Resource Index CDs.

The following diagram outlines a suggested folder structure for index projects.

```
Resource Index
      Maps
  ├── Flight Line Builder
  │       Toolbox
  │   └── Supplied Data
  │       ├── Base Maps
  │       │   └── Carto Report
  │       │       └── Photo Center File
  │       │               CSV
  │       │           └── MXDs
  │       │               └── Flight Line Files
  │       │                   └── Finished Index Tiffs
  │       └── Report Statistics
  └── Forest
      └── Photo Center
              Files
          └── Ungeoreferenced
                  Tiffs
```

Resource Index Maps

Flight Line Builder Toolbox

Supplied Data

Forest

Base Maps

Report Statistics

Carto Report

Photo Center Files

Photo Center File CSV

MXDs

Flight Line Files

Finished Index Tiffs

Ungeoreferenced Tiffs

APPENDIX II: Contract Wording Regarding Resource Indexes

C-9   DIGITAL SPOT INDEX OF AERIAL PHOTOGRAPHY

Within 15 days of receiving an acceptable roll and exposure listing from the Government, the Contractor shall prepare a digital spot index of aerial photography on the digital raster graphic file(s) (DRGs) furnished by USDA for each project. The scale and number of files are specified in Section B-1.3(h). The Contractor is to determine the location of individual photo centers to spot and identify them on the vector graphic file(s). (See Exhibit 2, Figure (a) for sample spot index.)

9.1   Labeling Requirements

All delineations and lettering shall be in solid black with all fonts in an Arial style. Line width and lettering size requirements while viewing the digital spot index at 100% scale are as follows:

FEATURE	SIZE	LINE WIDTH
Flight Line Width		0.8mm (0.030")
Tickmark Length	3.8mm (0.15")	0.8mm (0.030")
Circle Diameter	3.8mm (0.15")	
Font Size	2.5mm (0.10")	"Normal"

9.2   Layout Instructions

Locations of photo centers are to be shown on the map(s) by solid-filled circles and tick marks. All photo centers which require roll and exposure numbers, as specified in Section 9.3(a) below, shall be shown as a solid-filled circle. Draw the flight line by connecting the circles and plot the in-between tick marks proportionately in their approximate locations.

Location of photo centers shall be plotted within (30m) 100 feet of true location. Plotted coverage shall show photo centers of all terminal exposures and flight breaks as specified in Section C-5.3. Excess coverage outside of the specification requirements shall not be plotted on the spot index.

9.3   Lettering Instructions

Legible roll and exposure numbers shall be located next to each of the pertinent photo centers as shown on the spot index sample in Exhibit 2, Figure (a). The Government requires the lettering be split with the roll number on the left side and exposure number on the right side of the flight line. Leading zeros "0" shall not be used as part of any numbering. Letter the roll and exposure numbers of the following photo centers which are shown as solid circles:

(a) Terminal exposures of every flight segment including flight line terminal points, flight breaks, and reflights.

(b) Every fifth (5th) exposure (those with the last digit ending in five or zero) shall be numbered.

Flight lines shall be designated by placing the flight line number (LINE #) approximately ¼ inch (6mm) from the terminal photo center at both ends of the flight line. Flight lines shall be numbered as indicated on the raster graphic file(s). If there are more than two maps covering the project area, line numbers shall be placed on each intermediate map and at each end of the flight line to maintain continuity. On all partially submitted flight segments for interim indexing, line numbering shall be placed at the approximate beginning and/or ending terminal points of the flight line.

Where congestion occurs between indexed lettering and map detail, set a clear background area on the raster graphic file where roll, exposure, and flight line numbers occur to insure sharp reproduction of indexed information.

9.4   Title Block

The Contractor shall create a title block and insert the following items in the designated spaces:
Project name and code, film scale, type of film used, direction of flight, solicitation and item number, and name of Contractor. In the appropriate space, list of all rolls of acceptable photography appearing on the index sheet by: camera lens number, calibrated focal length of the lens, and calendar year flown. If more than one camera system is used, separate each camera and related information with a vertical line.
(See Exhibit 2, Figure (b).)

9.5   File Format and Naming Convention

The digital spot index shall be created as a Georeferenced TIFF image (GeoTiff) using the TIFF 6.0 Specifications and formatted to UTM NAD 83 projection. The index shall display in the correct NAD83 UTM zoning using Arc View or Arc GIS. If questions arise on the appropriate UTM zone, the contractor shall consult the COR for guidance. Use the following naming convention: index_[project code]_[date created as yyymmdd].tif **(Example: *index_612071_20071001.tif*)**

9.6   Interim Spot Index:

If the photography for the project(s) is not complete at the time of submission for inspection, an interim digital spot index shall be delivered.

9.7   Paper Copy of Digital Index:

Once the digital version of the spot index is accepted, the Contractor shall provide two (2) color paper copies of the digital spot index at the scanned map scale specified in Section B-1.3(h).

C-10   DIGITAL PHOTO-CENTER DATA FILE

10.1   Photo-Center Data File Description

Contractor shall prepare a digital photo-center data file for all aerial photography acquired under this solicitation. The file(s) shall be provided in ASCII comma delimited text format. A comma delimited header line shall precede the data in each file as shown in the example below.

The latitude/longitude coordinates shall be expressed in decimal degrees with five (5) decimal places of precision **(44.71936, -116.41498),** formatted to NAD83 datum, and be accurate within 30 meters (100 feet) of the true photo center location. Longitude must be expressed as negative space for western hemisphere. Higher accuracies obtain through use of GPS technology are desirable but not required. The photo-center data shall include the following attributes:

DESCRIPTION	MAXIMUM NUMBER OF CHARACTERS IN FIELD
Project Code	7
Film Roll Number	5*
Exposure Number	3
Date of Exposure (YYYYMMDD)	8
Flight Line Number	3*
Camera Lens Serial Number	10
Calibrated Focal Length in millimeters (mm)	7
Latitude Coordinate (DD.DDDDD)	8
Longitude Coordinate (-DD.DDDDD)	10
Flight Altitude in meters at camera (MMMMM.MM;MSL)	8

*Roll and flight line numbers should be padded with leading zeros as necessary.

Example:
code,roll,exp,date,flight,lens,cfl,lat,long,alt
614120,00107,222,20070820,004,12345678,210.002,**44.71936,-116.41498,7048.63**
614120,00207,230,20070820,004,12345678,210.002,**44.71936,-116.41498,7048.63**

10.2   Metadata File Description

Contractor shall include a metadata file containing, at a minimum, the following data:

Project Name (Name as appears in Section B)
Nominal Photo Scale
Nominal Lens Focal Length
 Film Type (CN, CIRP, B&W, etc.)
Number of Film Rolls
Coordinate System Datum
Coordinate Data Collection Method (GPS, Digitizing, etc.)
Estimated Accuracy of Coordinates (Within Meters or Feet)
Date ASCII Exposure Data File was created

Example: Payette NF, ID   1:15,840   210mm   CN   9   NAD83   GPS 30m   08162007

APPENDIX III: Index Request Form

REQUEST FOR DIGITAL INDEX

INSPECTOR:_____ DATE SUBMITTED: _____

ASSIGNED TO: _____ DATE COMPLETED:_____

Below is the information for the index title block for this digital index. Attached is the cartographic inspection report listing the approved roll and exposures, photo center file provided by the contractor, Index Base Maps and OPT files. The carto report should match the photo center file EXACTLY. Any discrepancies between the carto report and the photo center file should be brought to the attention of the QA inspector. When the digital index is complete please save the index in the Resource Index Drive and notify the inspector that it is ready for inspection. The address for mapping the resource hard drive is: \\utsaltlaked121\WD Combo (E).

Please include a copy of the entire photo-center file and metadata file on the CD/ DVD with the completed index(es). If you have any questions please contact the QA Inspector or the Contracting Officer's Representative.

This project requires _____ sheet(s) to be completed.

PROJECT NAME:	
CODE:	
FILM SCALE:	
FILM TYPE:	
DIRECTION OF FLIGHT:	
SOLICITATION NO:	
CONTRACTOR NAME:	
ROLL NUMBERS:	*To be filled in by GSB according to the index and specific map sheet(s) for the project area(s).*	
CAMERA LENS NUMBER:		
CAL. FOCAL LENGTH:		
CALENDAR YEAR FLOWN:		

Upon completion of the digital index please provide a copy to the QA inspector for inspection. Upon inspection and approval of the digital index, the QA inspector will request two paper copies.

Appendix IV: CD Label Template

ELEMENT	EXAMPLE
CD content	GeoTIFF files for the following image: index_614120_20070815.tif
Company name & logo	Acme Company
Contract number	USDA-FS-1-07, Item 1
Creation date	August 27, 2007
Project Name & code	Payette N.F. Project Code 614120

Project Name

Payette N.F.
Project Code 614120

Project Code

DIGITAL SPOT INDEX

Creation date

Company name
& logo (optional)

August 27, 2007

Produced for:
Aerial Photography Field Office
2222 W. 2300 S.
Salt Lake City, UT 84119

Under Contract:
USDA-FS-1-07, Item 1

By
Acme Company

USDA
Farm Service Agency

Contract no.

Contents:
GeoTiff files for the following image:
index_**614120**_20070815.tif
Photo Center Data File
Metadata File

CD content