PART III: POST-PROCESSING D-ASM MISSION DATA

Introduction

The digital aerial sketchmapping system software (GeoLink) outputs features in a digital file. Editing and data QA/QC (Quality Assurance/Quality Control) that formerly was done with a pencil and eraser is now done on softcopy using GIS software. We assume a basic knowledge of ESRI ArcView GIS 3.X software and GeoLink Mapping software.

This document outlines methods that aerial surveyors may use to edit and 'clean' (QA/QC) data prior to delivery to GIS personnel, who will compile the data and build GIS coverages according to reporting requirements. Clear communication between the surveyor and GIS staff about data format and content is essential. Also, it is difficult to discuss post –processing of data without addressing different data collection methods, so we will discuss different data collection situations, how to address them, and what the implications are when post-processing.

Many of the solutions described here use SketchTools, an ArcView extension that we developed to facilitate post-processing in ArcView. SketchTools is a series of utilities to help you process your points, lines, polygons, and associated feature tables. If you do not have SketchTools, please contact us.

General Post-Processing Steps

There are 9 general steps in preparing data for incorporation into the GIS. We recommend that the steps be completed in this order while recognizing that all steps may not apply to your particular survey:

1.) Translating GeoLink Proto-Shapefiles into ESRI shapefiles
2.) Building the ArcView Project (*.apr)
3.) Preliminary Inspection, Editing, and Cleaning of Attribute Data
4.) Changing the Position and/or Boundary of Features
5.) Adding Features.
6.) Merging Features
7.) Special Situations – Polygon Overlap Areas, Island and Oversize Polygons.
8.) Final Editing and Cleaning of Attribute Data.
9.) Re-Projecting Feature Shapefiles

The example data…

The examples used in this document were simulated with actual flight files from the southern Willamette Valley in Oregon (Fig. 3a). Features collected have three hypothetical attributes:

DCA – Damage Casual Agent
Four possible values – SNC, TA, BB, Bear

Severity – Three possible values – L, M, H

Host – Three possible values – DF, RC, A

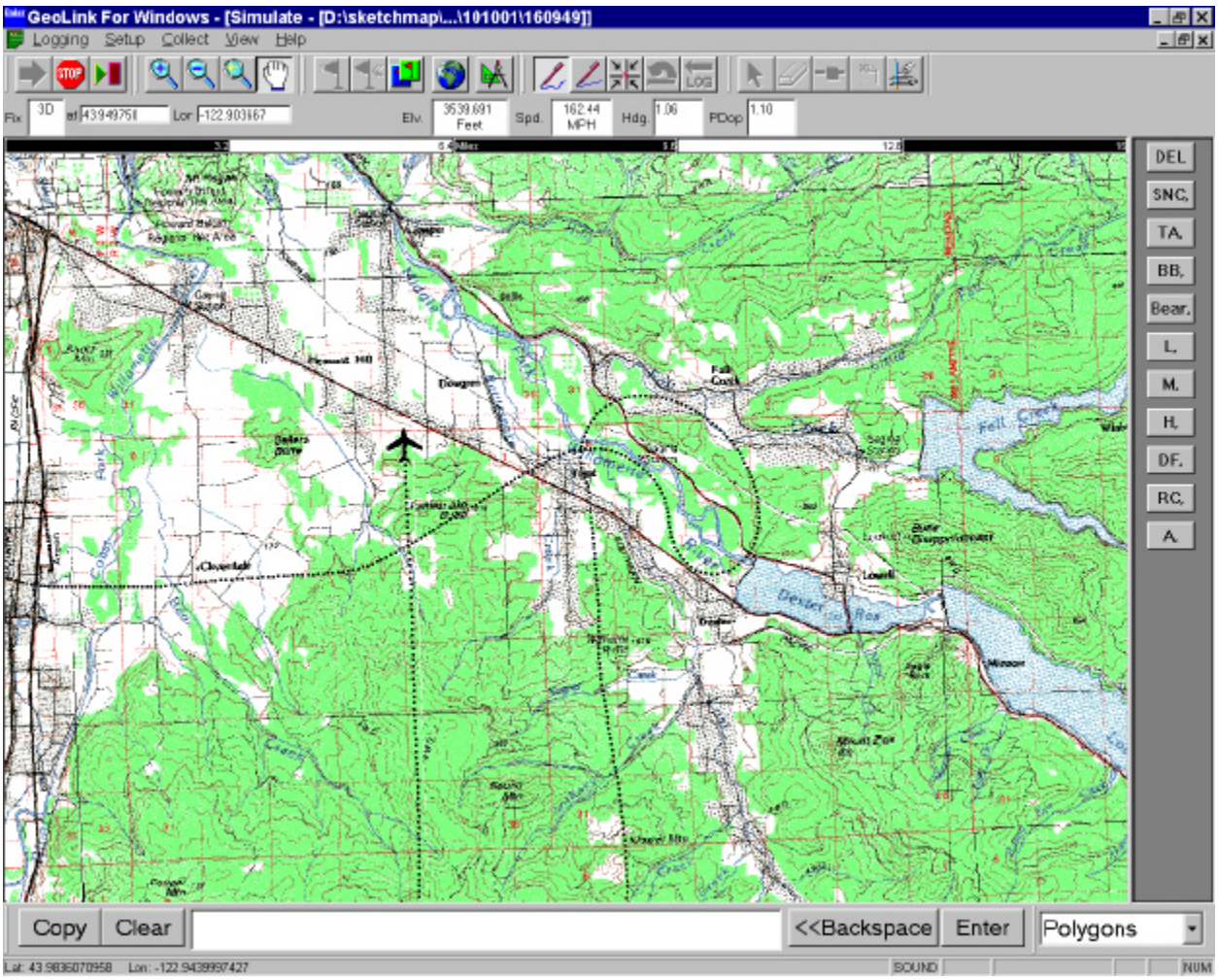

Fig. 3a. Datasets used were created by playing back GPS flight files and digitizing features.

Section 3.1 Post-Processing Steps

3.1.1 Translating GeoLink Proto-Shapefiles into ESRI Shapefiles

Raw feature data collected in GeoLink must be translated into true ESRI shapefiles before the data can be viewed and edited in ArcView. The translation step improves the accuracy of the features geolocation by interpolating feature position using all GPS points collected during the log session. Also, the translation step allows you to select from a number of supported datums and projections. We recommend translating to the unprojected state (Geographic) because unprojected shapefiles can later be projected 'on the fly' in ArcView to match your background DRGs that may be in different coordinate systems and projections. Remember, the translation function produces a softcopy file of the translated data; the original raw files are not altered.

Before translating, check the target projection and other settings for the translated files. From the project window, select 'Set-up' and 'Target GIS'. Make sure that the Coordinate system is set to default, the Target GIS type is ArcView Shapefile, and the 3D Output and Recalculate boxes are NOT checked (Fig 3.1.1a).

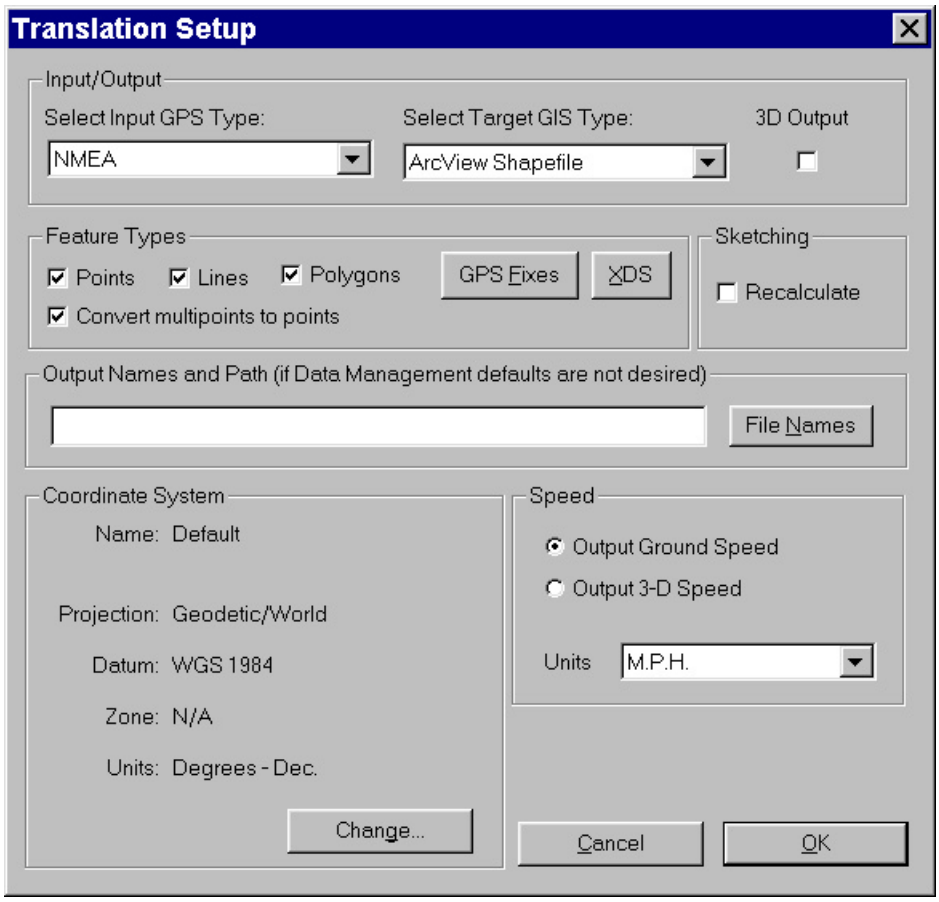

Fig.3.1.1a. Check Translation Setup before translating files.

For most GPS receivers, including the Garmin 12XL the 'Input GPS type' should be set to 'NMEA'.

Now, from the Project window, select ‘Process’ and slide down to ‘Translate’. This will open the Translate window; from this window select ‘Translate’ and slide down to ‘Select files’. You will then see a file selection window; navigate to the location of your raw data files (Fig. 3.1.1b).

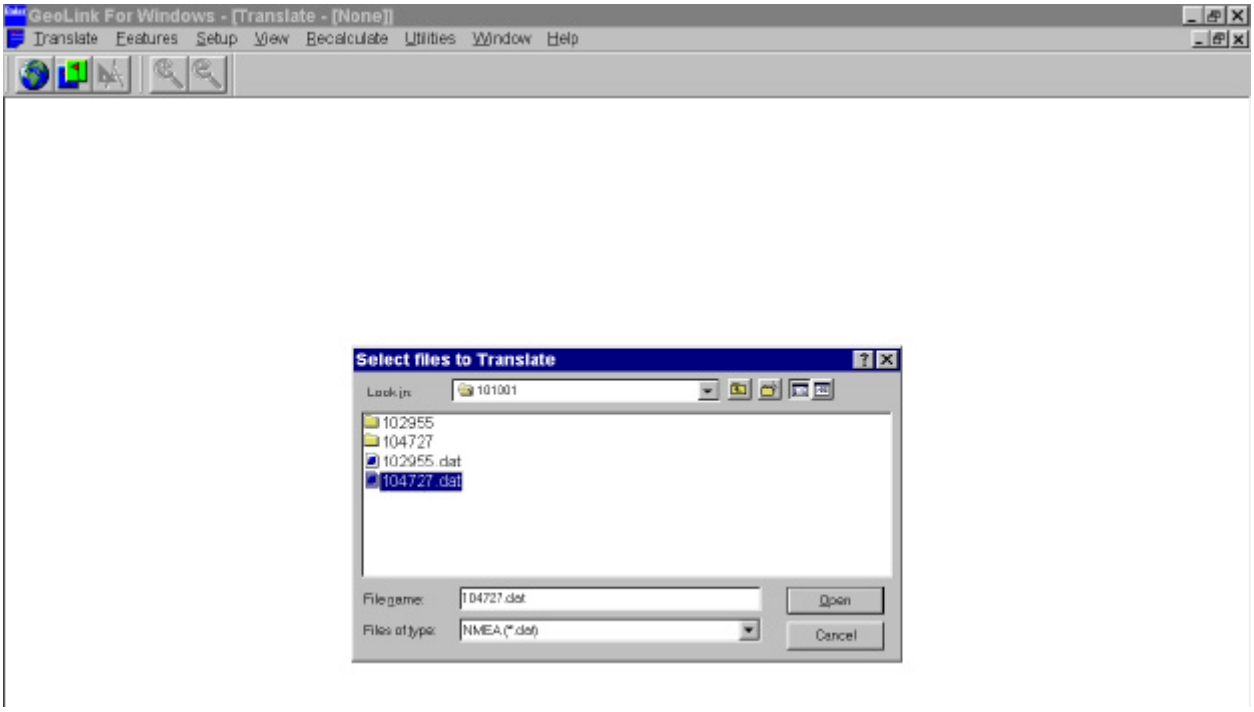

Fig. 3.1.1b. Select the GPS file to load the raw data to translate.

Select the files to translate by selecting the .dat file corresponding to the time when the survey was started. Remember, log files are stored in a date/time format and the .dat files are named for the time (24hrs) in which the log session began (hhmmss.dat). If features were collected during a log session, then the .dat file will have a corresponding file folder with the same name; this file contains the proto shapefiles.

The selected files will load. Translate the files by selecting ‘Translate’ and sliding down to ‘Translate Selected Files’.

3.1.2 Building the ArcView Project (.apr)*

Most of the softcopy editing will be done using ArcView GIS software, so first you need to build an ArcView project and add the background *.tif files and feature shapefiles that were translated from GeoLink. Open ArcView and add the background *.tif files (not the *.gor files, they cannot be used in ArcView) to a view.

If your raw GeoLink pseudo-shapefiles were translated into Geographic (unprojected) shapefiles (the recommended procedure), then you will next need to project the view. From the View Properties window, hit the ‘Projection’ button and specify the projection of your background data.

In the example in Fig. 3.1.2a, we have DRG (Digital Raster Graphics) data projected in UTM, NAD27, Zone 10. Finally, add the shapefiles of your features that were translated in GeoLink. By setting our projection properties accordingly, all projected DRGs and unprojected shapefiles should display correctly relative to one another.

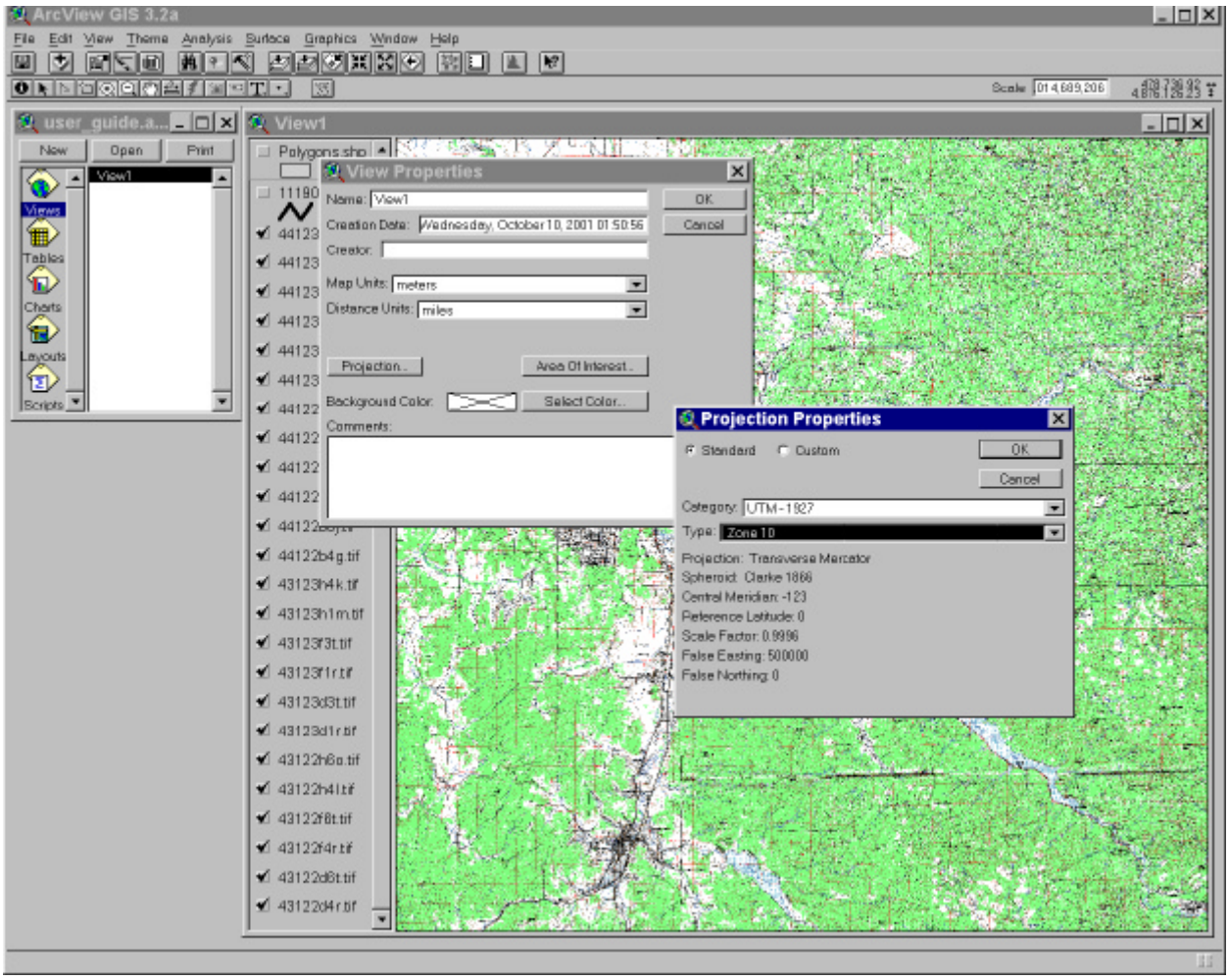

Fig. 3.1.2a. Set the projection of the view in ArcView to match your background data.

Now, we have a view containing shapefiles with features from our survey, corresponding background data, and a shapefile of our flight path (11905.shp)(Fig. 3.1.2b).

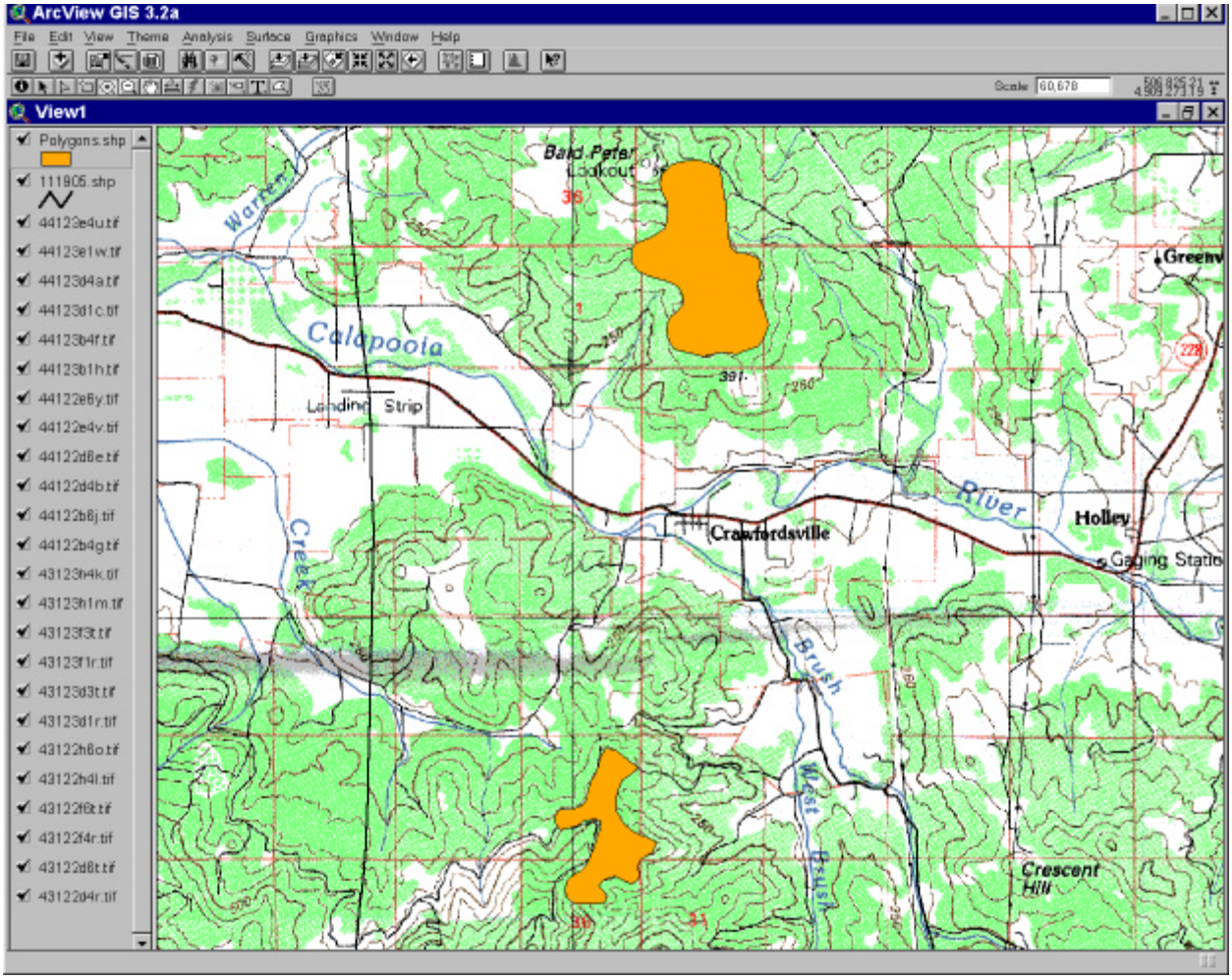

Fig. 3.1.2b. ArcView project with background maps and survey features.

Activate ArcView extensions…

Extensions are tools that add functionality to ArcView; often they are scripts that are invoked with buttons or pull-down menu items. Extension files (*.avx) must be placed in the extensions folder (usually C:\ESRI\AV_GIS30\ARCVIEW\EXT32) and must be turned on in the ArcView project.

You can turn on extensions by making the Project window active, choosing ‘Extensions’ from the ‘File’ pull down menu and checking the box next to the extension. For a brief description of the extension, highlight the extension (Fig. 3.1.2c).

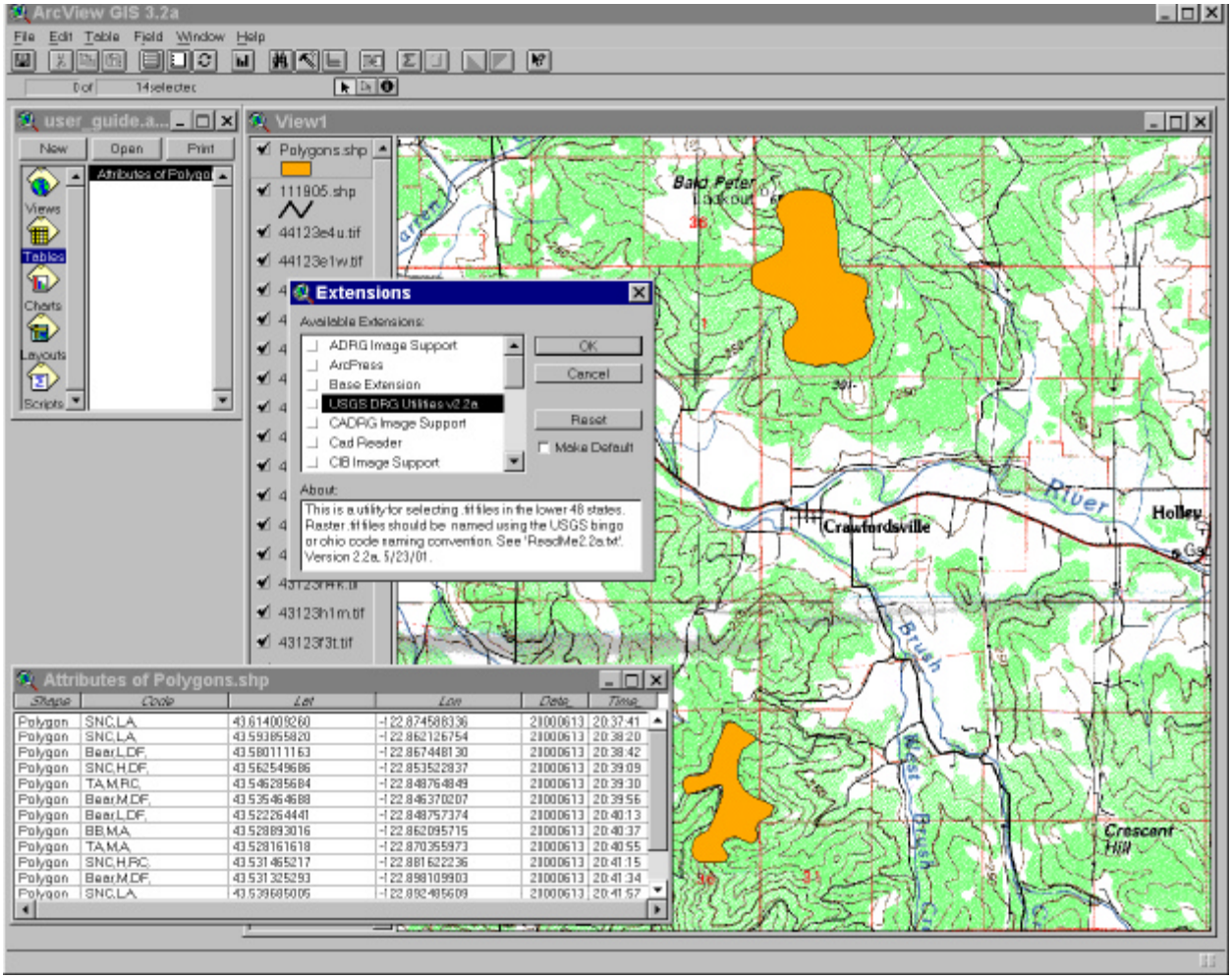

Fig. 3.1.2c. Turn on extensions that add functionality to your ArcView project.

3.1.3 Preliminary Inspecting, Editing, and Cleaning Attribute Data

The next three steps (steps 3.1.3, 3.1.4, and 3.1.5) should be completed as quickly as possible after the survey while the mission is still fresh in your mind. These steps should also be done either by, or in the presence of the surveyor, since questions will frequently arise which require the recollection of the person who originally digitized the features, especially when damage is extensive or features are numerous and overlapping.

The first step is to bring up the feature attribute tables for all digitized features. Inspect the table for records that contain the code “del”. Remember that these features denote errors in digitizing and should be deleted. Select all attribute records for these features and delete them. When you delete the records from the table, you are automatically deleting the features on screen as well.

The next step is to examine the feature attribute table and make sure that all of the 'Code' values are entered properly. The possible attributes for our features are:

DCA (Damage Casual Agent) -- Four possible values – SNC, TA, BB, Bear
Severity – Three possible values – L, M, H
Host – Three possible values – DF, RC, A

These attributes should be entered in order and separated by commas within the 'Code' field. Fig. 3.1.3a shows some of the errors that you may see. You can edit attribute tables in ArcView.

Attributes of Post_processing.shp

Shape	Code_	Date__
Polygon	SNC,L,A,	20000613
Polygon	SNC L,A **1**	20000613
Polygon	Bear,L,DF	20000613
Polygon	SNC,H,DF	20000613
Polygon	TA,M,RC	20000613
Polygon	Bear, M,DF	20000613
Polygon	DF,Bear,L **2**	20000613
Polygon	BB,M,A	20000613
Polygon	TA,,A **3**	20000613
Polygon	SNC,H,RC	20000613
Polygon	Bear, M,DF	20000613
Polygon	SNC,L,,A **4**	20000613
Polygon		

Attribute errors

1. **No comma separating 2nd and 3rd attributes.**
2. **First and 2nd attributes reversed.**
3. **Second attribute missing.**
4. **Extra comma between the 2nd and 3rd attributes.**

Fig. 3.1.3a. Example attribute entry errors.

Correcting any comma entry errors is important if you plan on using the comma parsing utility in SketchTools (Step 3.2.8). Fig. 3.1.3b shows the same table with all errors corrected.

Attributes of Post_processing.shp

Shape	Code_	Date__
Polygon	SNC,L,A,	20000613
Polygon	SNC,L,A	20000613
Polygon	Bear,L,DF	20000613
Polygon	SNC,H,DF	20000613
Polygon	TA,M,RC	20000613
Polygon	Bear, M,DF	20000613
Polygon	Bear,L,DF	20000613
Polygon	BB,M,A	20000613
Polygon	TA,M,A	20000613
Polygon	SNC,H,RC	20000613
Polygon	Bear, M,DF	20000613
Polygon	SNC,L,A	20000613
Polygon		

Fig. 3.1.3b. The attribute table from figure 3.1.3a with errors corrected.

The remaining fields in the attribute table are automatically populated by GeoLink and not need be edited.

3.1.4 Changing the Position and/or Boundary of Features

An important part of your QA/QC efforts is to check your digitized features and make sure that they are properly positioned. In ArcView, select the theme to which you wish to make changes, then go to *Theme ®Start Editing*. There are three primary tools for editing shapefile features (Fig. 3.1.4a).

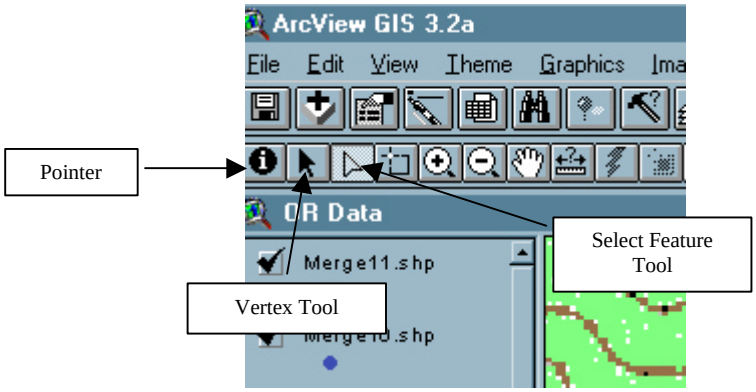

Fig. 3.1.4a. Tools to edit features in ArcView include the Select Feature tool, the Vertex Tool, and the pointer.

Select the feature that you want to edit using the *Select feature tool.* You can reposition the selected feature using the *Pointer*. To move, add, or delete vertices from lines and polygons, use the *Vertex Tool*.

3.1.5 Adding Features

The situation may arise where you have a few features that have been recorded on paper maps and you want to add these features to a softcopy file created in GeoLink. Adding features to a softcopy file can be done in ArcView after the file has been translated. In ArcView, select the theme that you want to make additions to, go to *Theme ®Start Editing.* In the example in Fig. 3.1.5a, we will be adding a polygon to the 'Polygons.shp' shapefile, so we will use the polygon tool to draw a new polygon.

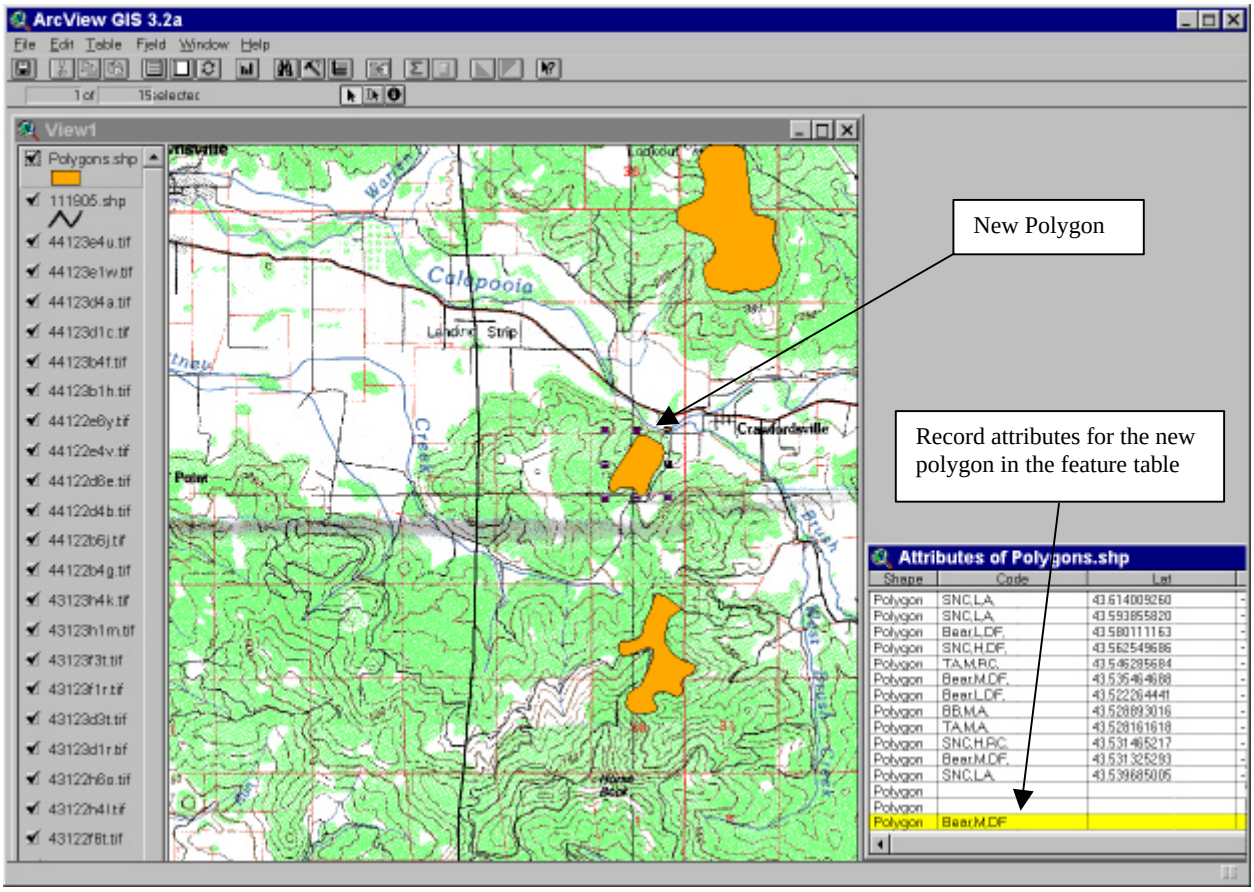

Fig. 3.1.5a You can add new features in any existing shapefile in ArcView.

Open the theme's feature table by highlighting *Theme ®Table*. Populate the fields of your newly added feature.

The same basic procedure also applies to Point or Line shapefiles.

3.1.6 Merging Features

During the course of the survey season, you may have multiple feature shapefiles from surveys of different geographic areas that you want to combine into a single shapefile. The SketchTools utility 'Merge Themes' will merge multiple themes into a single theme. See the SketchTools Users Manual, section 3.1.8)

3.1.7 Special Situations – Polygon Overlap Areas, Island, and Oversize Polygons.

NOTE: Prior to beginning the remainder of the post-processing utilities, display the tables of all features and make certain that no records are selected.

During the course of your survey, you may want to record some polygons with islands or overlap areas within them, or you may have some very large polygons that extend beyond what you can see at any one given time from the plane. Here is how to handle these situations.

Polygon overlap areas and island polygons – The first thing to determine is whether your overlaps are all within the same file, or if you will have overlaps after you merge/union two polygon shapefiles. If they are in the same file, then you can separate out the polygons that overlap and put one of each overlapping pair into a separate file and proceed with the method described below. The 'Select overlapping polys..' utility in SketchTools can help by identifying overlapping polygons. If you have numerous overlapping polygons, you may want to process the coverage in Arc/Info using the methods described in Appendix E.

If the overlapping polygons are in two separate files, use the 'Union poly themes..' utility in SketchTools to combine the two files (see SketchTools Users Manual, section 6.1.7). For example, consider the polygons in Fig. 3.1.7a.

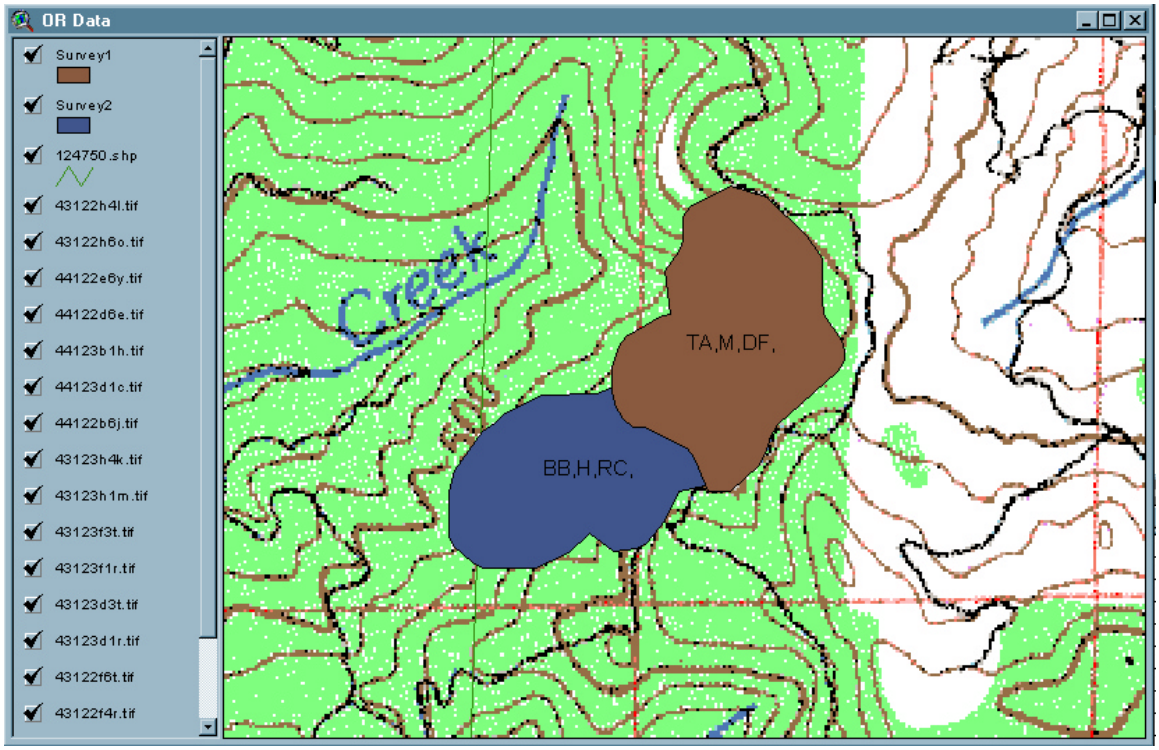

Fig. 3.1.7a. These two polygons are in separate shapefiles, survey1 and survey 2.

After running the 'Union poly themes..' utility, the overlapping area of the polygons is a distinct polygon and contains the attributes of both parent polygons. Examining the attribute table shows that there is an attribute named 'Code' that contains the attributes of the first parent polygon, and one named 'Code_' that contains the attributes of the second parent polygon. This feature attribute table can be edited to remove extraneous fields using TableTools. Now the overlap areas are distinct polygons with both primary and secondary attributes (Fig. 3.1.7b).

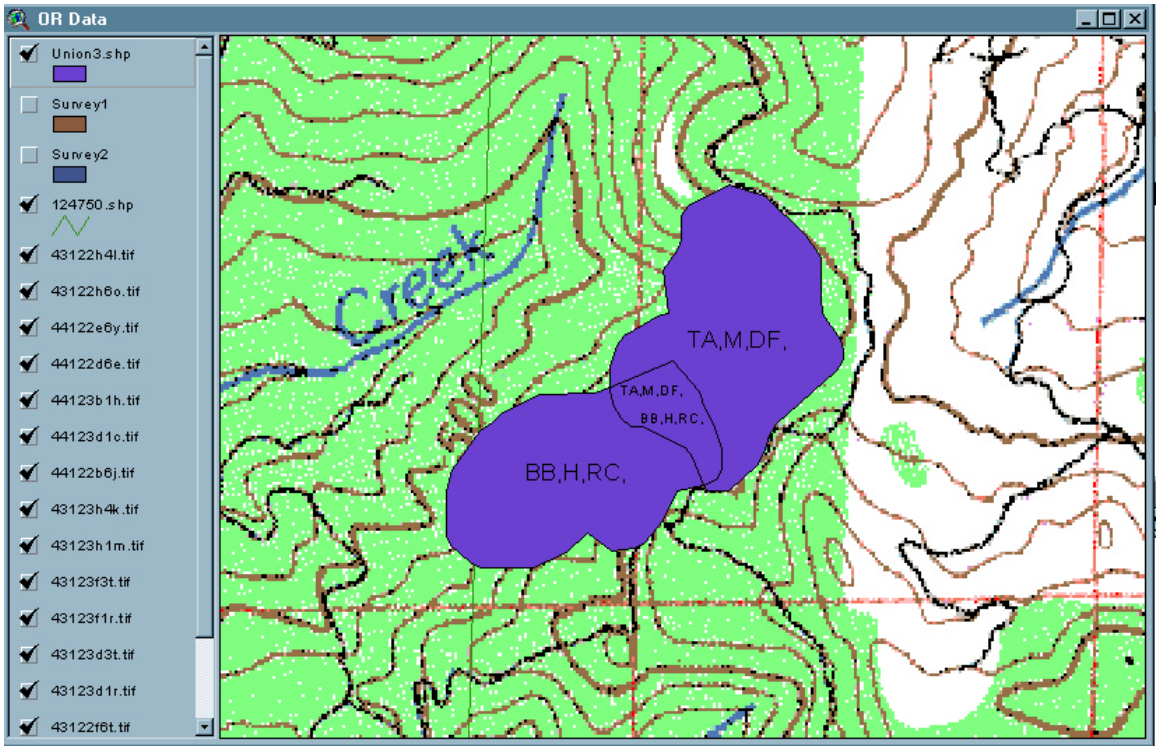

Fig. 3.1.7b. The overlap area contains the attributes of both 'parent' polygons.

The same methods apply to ***island polygons***, since islands are just overlapping polygons whose borders are completely within another polygon.

Oversize polygons are large areas of damage where you cannot visualize the entire boundary of the damage area from one spot during the survey flight. One tactic in mapping these large areas is to digitize the boundaries that you can see as line features. At another point in the survey flight, you will be able to visualize the rest of the damage area and digitize a line to complete the boundary. Make sure that you overlap the lines (Fig. 3.1.7c). Using this method, an infinite number of lines can represent a polygon.

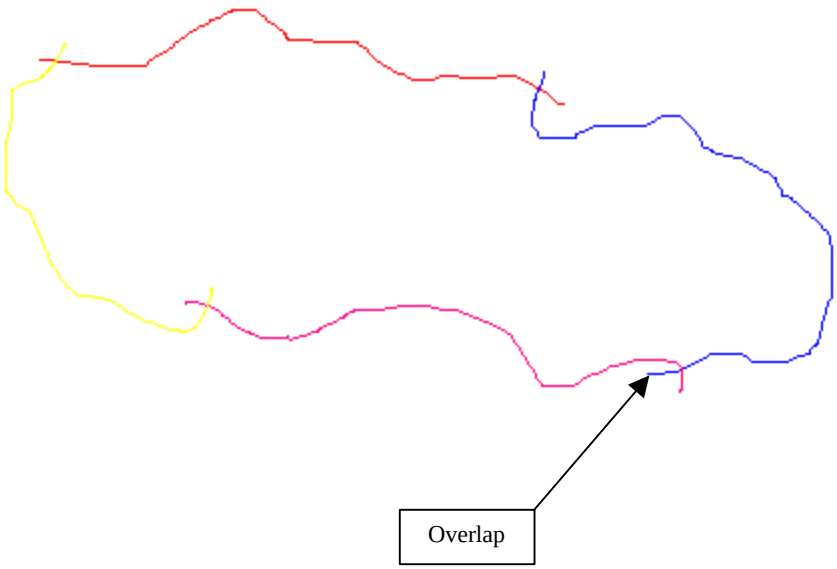

Fig. 3.1.7c. Linking a series of lines together is one way to record an oversized damage area. Lines are colored for emphasis. To make sure that lines intersect, digitize them with adequate overlap.

Another (and possibly easier) way to create oversized polygons (see section 3.1.1 of the SketchTools Users Manual) is to link two or more polygons in GeoLink by overlapping them and attributing them with the same code value. When post-processing the polygon shapefile in ArcView, use the 'Dissolve boundaries' utility in SketchTools to remove the boundaries between the polygons to form one large polygon (Fig. 3.1.7d).

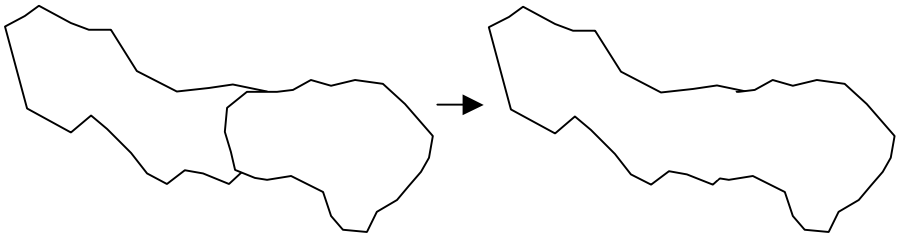

Fig. 3.1.7d. The dissolve tool eliminates boundaries between polygons, creating a larger polygon.

Only those polygons that have the same user-defined attributes will have their boundaries dissolved; thus islands and desired overlap areas will be preserved in the resulting shapefile. See the SketchTools Users Manual, section 3.13.

3.1.8 Final Editing and Cleaning of Attribute Data

Now you can use the 'Parse a comma delimited field..' utility in SketchTools. This tool breaks out the comma-delimited attributes and places them into their own fields (Fig. 3.1.8a). See Section 3.3.3 of the SketchTools Users Manual.

Calculating acreages for polygons – The 'Calculate acres..' utility in SketchTools will add or update acreage fields in your polygon attribute table (see section 3.1.9 of the SketchTools Users Manual). If you intend to calculate any trees per acre values based on a "# of trees damaged" value that you collected, it is important that you do this calculation after you have dealt with overlapping/island polygons, since processing these will change acreage values.

Attributes of Area.shp

Shape	Code	Agent	Damage_leve	Host
Polygon	SNC,M,DF,	SNC	M	DF
Polygon	TA,M,RC,	TA	M	RC
Polygon	BB,H,RC,	BB	H	RC
Polygon	Bear,M,DF,	Bear	M	DF
Polygon	SNC,Bear,M,	SNC	Bear	M
Polygon	BB,L,RC,	BB	L	RC
Polygon	Bear,H,DF,	Bear	H	DF
Polygon	Bear,H,DF,	Bear	H	DF
Polygon	Fire,H,PP,	Fire	H	PP

Fig. 3.1.8a. The 'Code' field has been parsed into three new fields in this table.

3.1.9 Re-Projecting Feature Shapefiles

You may want to convert your data into another projection/coordinate system, either to analyze or display the data with other datasets or perhaps you will be providing the data to another agency and they prefer a different coordinate system.

ArcView 3.2 contains a projection utility that will reproject shapefiles. It is an extension; to enable it go to *File®Extensions* and click on 'Projection utility wizard'. To launch the wizard after the extension has been loaded, go to *File®ArcView Projection utility*. The dialog boxes will step you through the reprojection process. You will need to know all the parameters of both the current projection of your data and the one you would like reproject.