

GPS Advanced Applications for Natural Resources

TEC7133

November 18-20, 2003

Phoenix, AZ

Offered by:

**U.S. FISH AND WILDLIFE SERVICE
National Conservation Training Center**

INSTRUCTORS:

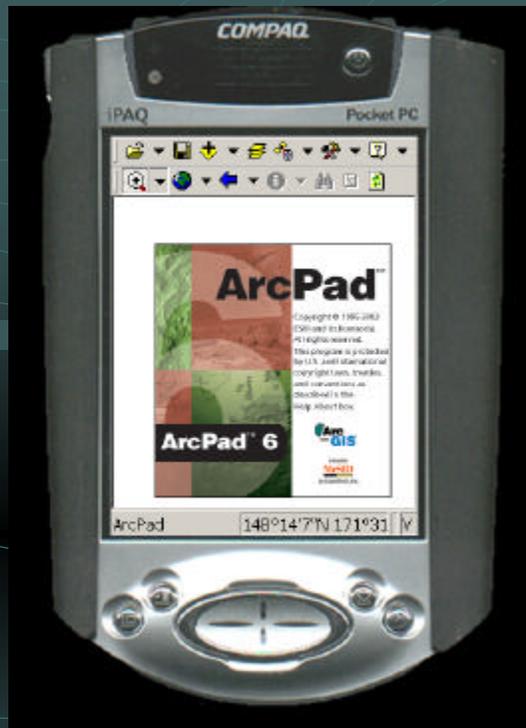
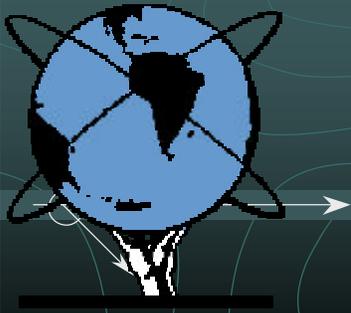
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ArcPad Overview



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What is ArcPad?

- Mobile GIS mapping “software” designed for handheld and mobile devices
- Developed by Environmental Systems Research Institute (ESRI)
- Part of the “ArcGIS” system

Why ArcPad?

Easily bring your GIS data into the field



Why ArcPad?

Integrate your existing GPS devices



Why ArcPad?

- Standardize data collection
- Streamline data collection process
- Simplify importing GPS data to your GIS

ArcPad System Requirements

✍ Any handheld or mobile device that runs Windows CE operating system

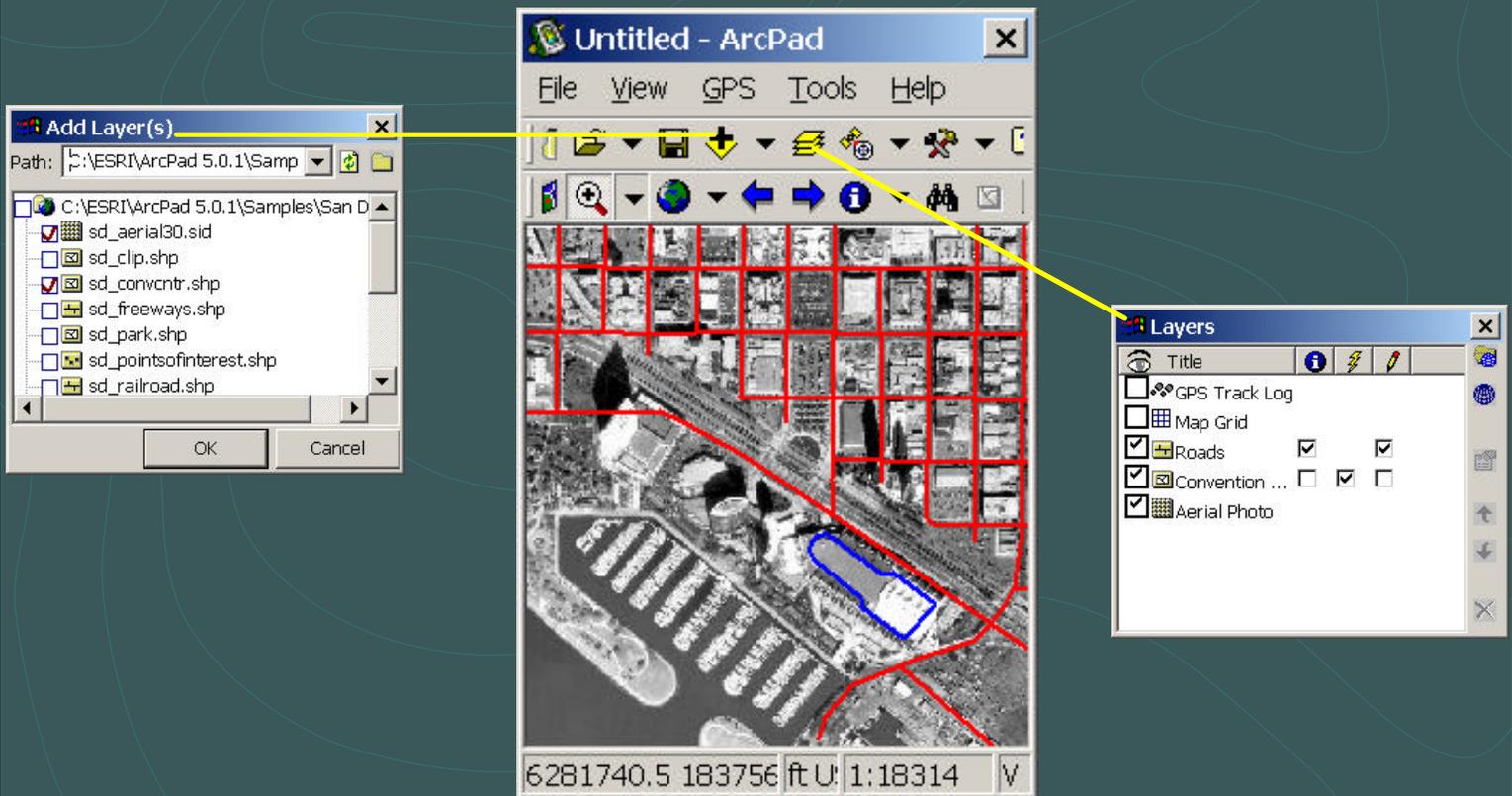
- Pocket PC, HP Jornada, Toshiba, Panasonic Toughbook...
- *Does not work with Palm Pilot/Handspring (PALM OS)*
- Also runs on PCs running Windows 95, 98, NT, 2000, XP
 - Tablet PCs (Windows XP) were recently added in version 6.0

✍ Microsoft ActiveSync 3.7

- Latest version can be downloaded from web

<http://www.microsoft.com/windowsmobile/resources/downloads/pocketpc/activesync37.msp>

Add/Manage GIS Layers



Data Formats Supported

✍ Shapefiles (vector data)

Raster (DOQQs, DRGs..)

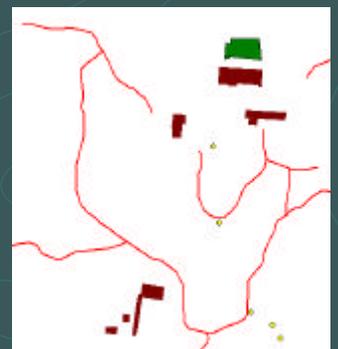
JPEG

MrSID

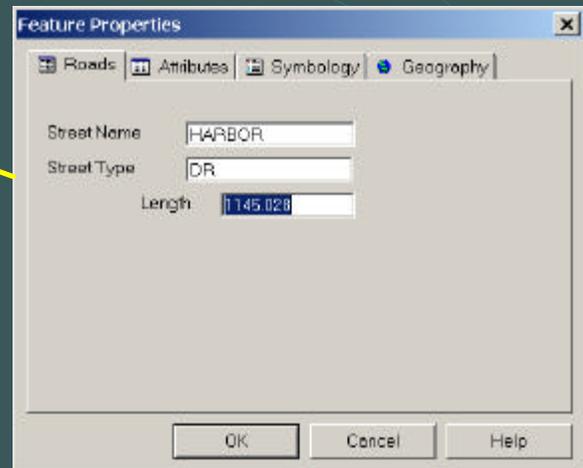
BMP

CADRG

PNG



Query & Edit Features



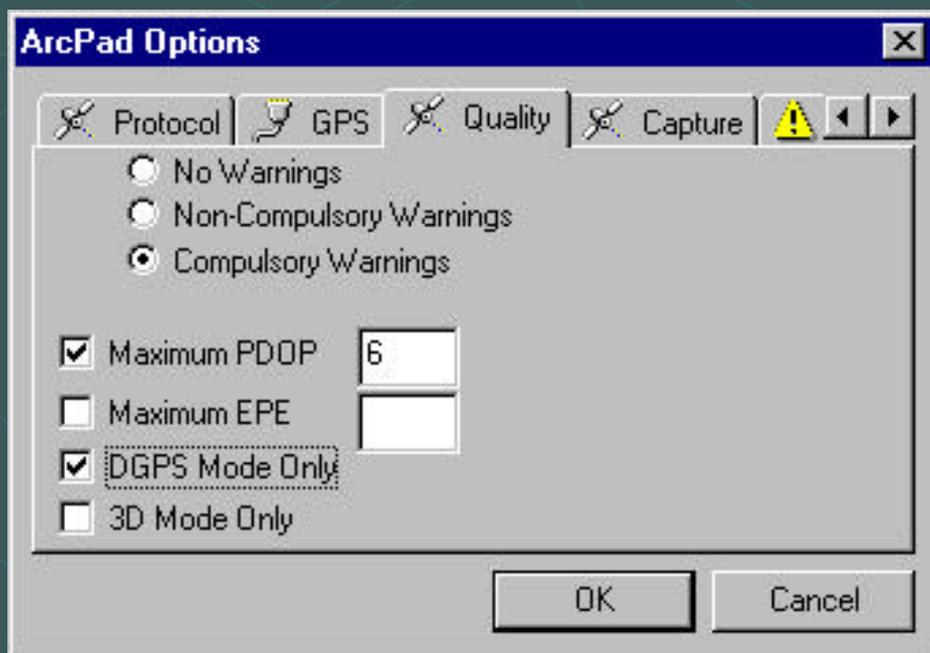
Obtain Area, Distance & Direction Information



Measurement Information	
From location	6278945.0E, 1838792.6N
To location	6278914.7E, 1838802.7N
Direct distance	9.721m
Distance along	1.489km
From -> To	288°
To -> From	108°
Closed Area	10.73 ha

Data Collection Options

✍ Ability to set GPS quality and capture rules



Other ArcPad Features

- ✍ Navigation
- ✍ Hyperlink (hot link to photos, docs)
- ✍ Track Logs
- ✍ Add data from Internet via wireless technology
- ✍ **Ability to CUSTOMIZE !**

ArcPad Customization

- ✍ Customization done using separate software called "ArcPad Studio"
- ✍ Design forms for attributing features
 - Layer definition files (*.apl)
 - Basic forms can now be created without ArcPad Studio!
- ✍ Modify interface (new toolbars, buttons)
 - Configuration file (arcpad.apx)
 - Applets (*.apa)
- ✍ **No programming experience required!**

Design Custom Forms



Fire Perimeter Form

Fire Info | Collection Method

Unit ID: 89238

Fire Name: Congaree

Fire Number: 158930-2344

Collection Date (YYYYMMDD): 10/ 3/2002

Collection Time (Military, HHMM): 1645

OK Cancel

Fire Perimeter Form

Collection Method | Geograp

Collection Method: GPS Digitized

Source: Garmin eTrex

Differential Correction: WAAS

Travel Method: Helicopter

OK Cancel

Modify ArcPad Interface



Standard Toolbars



Customized Toolbars

How much does ArcPad cost?

- ArcPad - \$205
- Application Builder - \$614
 - ArcPad Studio (customization software)
 - One ArcPad license included
 - Any forms/configurations/applets can be distributed to multiple users

NOTE: Prices are based on 50% off GSA price discount available through DOI Enterprise agreement

Handheld Devices used in Class

✍ Compaq iPAQ Pocket PC – Model #3650

- 32 MB of RAM
- 16 MB of ROM
- Windows CE 3.0 Operating System

✍ TeleType GPS World Navigator

- PCMCIA Card
- 12 channel receiver

Handheld Devices used in Class

Trimble GeoCE

- 206 MHz StrongARM processor
- 64 MB of RAM
- Windows CE 3.0 Operating System

GeoXM Model

- Integrated GPS
- 8 channel receiver
- WAAS

Section 2

Getting Familiar with ArcPad

Section 2 Objectives:

At the end of this section, you will be able to:

- Utilize the basic functionality of ArcPad software on a handheld device

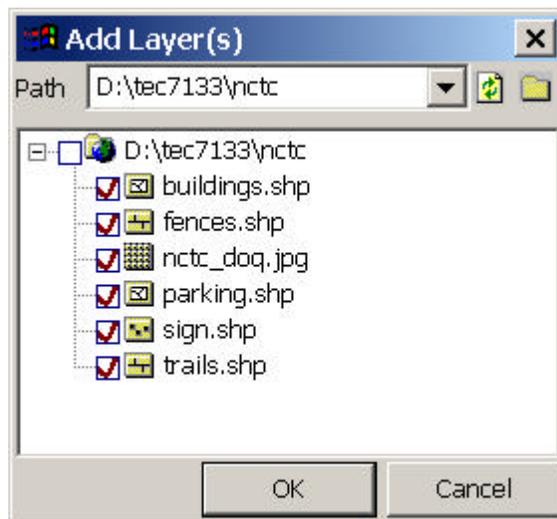
Getting Familiar with ArcPad 6

In this exercise you will explore some of the basic functionality of ArcPad 6.

NOTE: This exercise was developed using ArcPad version 6.0.2

Adding layers and setting their properties

1. From the Windows desktop, double click on *ArcPad* to launch the program.
2. Click the **Add Layer**  button.
3. In the *Add Layers* dialog, click on the **Folder**  button and navigate to the `\tec7133\nctc` folder. Click **OK**.
4. Check all boxes to add the following six layers to ArcPad:



TIP: If you put a check in the box next to the folder, all layers in the folder will be added to your map.

5. Click **OK** after checking the above layers.
6. Click on the **Layers**  button.

7. In the *Layers* dialog, click on the **Projection Information**  button.

What is the map projection being used?

Projection Type: _____

Which datum is being used?

Datum Name: _____

Close the *Projection Information* dialog.

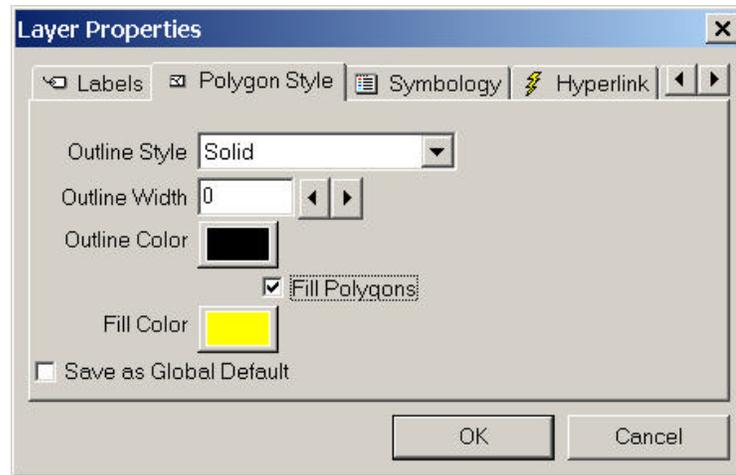
NOTE: In this example, all of the shapefiles added to the ArcPad project have an associated projection file (*.prj). Therefore, the presence of this file automatically defines the map projection for the ArcPad map. If the shapefiles did not have projection files, ArcPad automatically assigns decimal degrees based on the WGS84 datum as the default projection for the ArcPad map. Therefore, if your shapefile does not have a projection file and it's native format is not decimal degrees, you must use the **Choose Map Projection Definition File**  button and define a map projection for the ArcPad map. Numerous map projection definition files are provided by ArcPad and located in the *C:\Program Files\ArcPad\Coordinate Systems* folder.

8. From the *Layers* dialog, click on the *Buildings.shp* layer to select it. Click on the **Layer Properties**  icon. Scroll over and select the *Symbology* tab. Uncheck the *Use Symbology* box. This will allow you to assign a single symbol to represent building features.

NOTE: The symbology for this layer was defined using ArcPad Tools. ArcPad Tools is an extension available for ArcView 3.X and ArcView 8.X users. *You cannot create unique value legends from within ArcPad.*

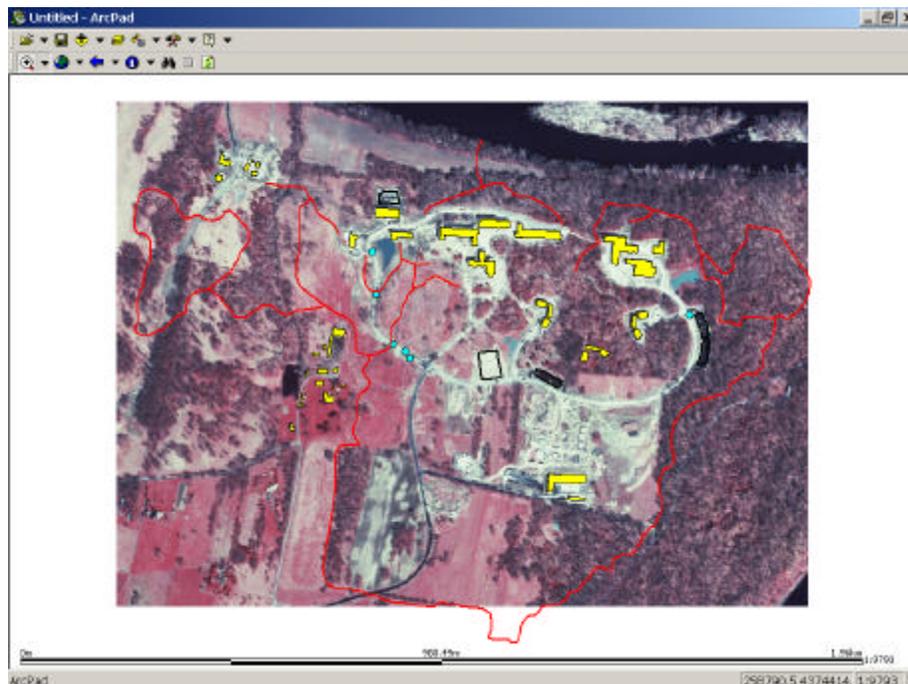
9. Now click on the *Polygon Style* tab. Click in the *Fill Color* box. A new dialog appears. Change the fill color to yellow. After clicking on the color desired, click **OK**. Check the box next to *Fill Polygons*. Your screen should look similar to the one given below.

NOTE: If you check *Save As Global Default*, these parameters will become your default settings for all polygon features.



10. Click **OK** to close the *Layer Properties* dialog. Your building features are now displayed using the new yellow symbol you just assigned.
11. From the *Layer Properties* dialog, change the symbology of the *Fencing* layer using the *Line Style* tab.
- Style – Solid
 - Width – 1
 - Color - Green
12. From the *Layer Properties* dialog, change the symbology for the *Parking* layer using the *Polygon Style* tab.
- Outline Style – dash
 - Outline Width – 2
 - Outline Color – Black
 - Ensure the *Fill Polygons* box is unchecked

13. From the *Layer Properties* dialog, change the symbology for the *Signs* layer using the *Point Style* tab.
 - a. Outline Color – Black
 - b. Fill Points - Checked
 - c. Fill Color – Light Blue
 - d. Size – 4
14. From the *Layer Properties* dialog, change the symbology of the *trails.shp* layer using the *Line Style* tab.
 - a. Style – Solid
 - b. Width – 2
 - c. Color – Red
15. Your map should now look similar to the one below.



16. Click on the **Save Map**  button. Save your map as **NCTC.APM** and store in the `\\tec7133\nctc` folder.

PLEASE STOP HERE !

Using ArcPad zoom tools

1. Click on the dropdown arrow next to the **Zoom Full Extent**  tool and select **Zoom to Layer**. Now, select the *Buildings.shp* layer. This zooms you to the extent of this layer.
2. From the same dropdown menu, click once on the **Fixed Zoom In** tool.
3. Click on the dropdown arrow next to **Go Back To Previous Extent**  tool and select **Create Bookmark**. In the *Name* section, type in *Field Exercise Area* and click **OK**.

NOTE: This creates an *ArcPadBookmarks.apx* file. This file is always stored in your *My Documents* folder.

4. Click the **Zoom Full Extent** button .

TIP: If your image does not redraw correctly, simply click on the **Refresh**  button. This button is located on the far right of the *Browse Toolbar*.

5. Now go ahead and test the bookmark you just established. Click again on the dropdown arrow next to **Go Back To Previous Extent**  tool, select **Zoom to Bookmark** and choose **Field Exercise Area**.
6. Spend a few minutes getting comfortable with the other zoom functions available in ArcPad. Ensure you try the **Zoom In**  tool. There is also a **Pan**  tool available from the dropdown arrow next to the **Zoom In** tool.

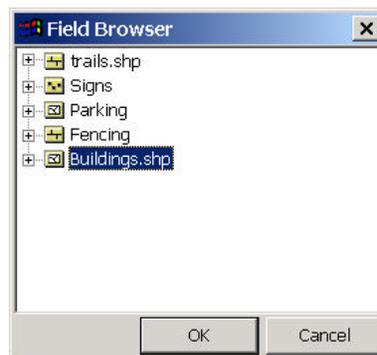
PLEASE STOP HERE!

Querying features using ArcPad

1. Use the **Identify**  tool and click on any feature from the *Sign* layer. The *Signs* dialog will open. The *Site Details* form page appears. Click on the *Sign Information* tab to see additional attributes for this feature.

NOTE: The attributes for this layer are displayed using forms. There are several ways to create forms for your layers. Forms are stored in a layer definition file (*.apl). These forms allow you to easily attribute your features in the field when collecting data using your GPS

2. Close the *Signs* dialog.
3. Use the **Identify**  tool and click on any building feature. Notice there are no form pages associated with this layer. Close the *Feature Properties* dialog for the buildings layers.
4. Click on the **Zoom Full Extent**  button.
5. Click the **Find**  button. In the *Find Dialog Box* click on the *Select Layers*  button.
6. The *Field Browser* dialog appears. Select *Buildings.shp* and click **OK**.



NOTE: In this example, we don't have to specify a field since the attribute we are searching for is contained in the first field. The first field in the layer is the default setting. To specify another field, you click the + sign next to the layer name and select the field you want to use.

7. In the *Find* section type in **aldo**. See example below. Now click the **Search**  button.



8. The feature record that contains *aldo* is displayed in the lower portion of the dialog. Click on the record to select it and then click the **Go To**  tool. The dialog will automatically close and the selected feature is labeled in the display.
9. To clear the selected feature, just click the **Clear Selected**  button.
10. Now use the **Find**  tool again and using the *Buildings.shp* layer, locate the **Rachel Carson Lodge**.

TIP: You don't have to enter the whole text string in order for ArcPad to find this attribute value.

PLEASE DO NOT CLEAR THE SELECTED FEATURE!

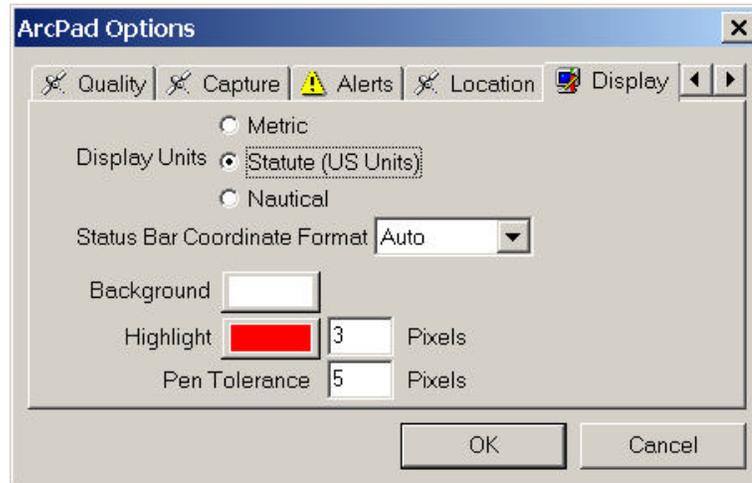
11. Let's assign a hyperlink to features in the *Buildings.shp* layer. Click on the **Layers**  button. Now, select the *Buildings.shp* layer and click the **Layer Properties**  button.
12. Scroll to the right and click the **Hyperlink** tab. Specify the Hyperlink field to be PHOTO and click **OK**. Close the *Layers* dialog. We have just assigned a hyperlink field for the *Buildings.shp* layer. The PHOTO field contains the name of the image to be displayed when the hyperlink tool is used.

NOTE: ArcPad only supports *.bmp, *.jpg and *.sid image formats.

13. Click on the dropdown box next to the **Identify**  tool and select the **Hyperlink**  tool. Click on the Rachel Carson Lodge (highlighted and labeled on your map). An image of this building appears. Close Internet Explorer when finished viewing the image. Clear the selected feature.

Using Measuring Tools in ArcPad

1. Click on the arrow next to the **Tools**  button and select Options. Scroll to the right and click on the *Display* tab. Change the *Display Units* to Statute (US Units) and click **OK**.



2. Zoom to the full extent of your map. Now activate the **Zoom In**  tool. Zoom to the field that lies north of the main campus by clicking and holding down the left mouse button. Drag and release when the area is defined.



3. Click on the dropdown box next to the **Hyperlink**  tool and select the **Measure**  tool. You will delineate this field to calculate the area. Double click to enter a point and continue entering points until the area is delineated. Return to the point of origin and click on the **Measure**  tool again. A dialog appears with the measurement information.

What is the acreage?_____.

4. Now use the **Freehand Measure**  tool on the same area. Simply click and hold while delineating the field. Compare these results with the acres obtained using the **Measure**  tool.

Which method is probably more accurate? _____

5. Experiment with the **Radial Measure**  tool.

Do you see any applications for this tool?_____

6. Use the **Measure**  tool and determine the walking distance from the *Instructional East* building to the *Commons* building.

What is the walking distance (distance along)? _____(*in meters*)
How about as the crow flies (direct distance)? _____(*in meters*)

TIP: You need to change the display options to metric. Remember how this is done?

7. If time permits, use the supplied ArcPad Toolbar reference sheets and experiment with some other ArcPad functions not covered in this exercise.

Section 3

Preparing GIS Data for ArcPad

Section 3 Objectives:

At the end of this section, you will be able to:

- Prepare GIS data for use in ArcPad utilizing ArcPad Tools for ArcGIS
- Transfer files to your handheld device using ActiveSync
- Create MrSID files from imagery using ArcToolbox

Preparing GIS Data for ArcPad

In this exercise you will learn how to use ArcPad Tools for ArcGIS. This extension allows you to easily prepare your GIS data for use in ArcPad.

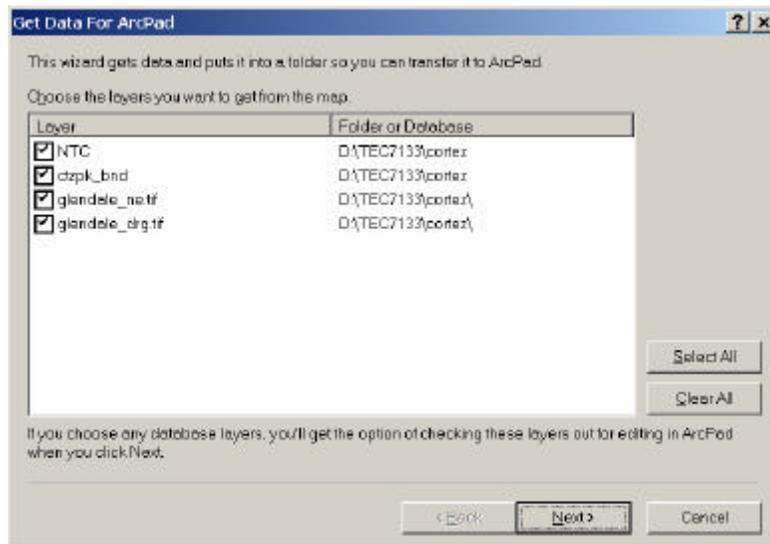
NOTE: This exercise was developed using ArcView 8.3 (SP3) and ArcPad 6.0.2.

Using ArcPad Tools for ArcGIS

1. Start ArcMap.
2. Open the Cortez map document (*cortez.mxd*) which is located in the `\\TEC7133\cortez` folder.
3. From the **View** menu, select **Toolbars** tab and put a check next to ArcPad. This loads the ArcPad Tools for ArcGIS toolbar. Dock the toolbar if desired.

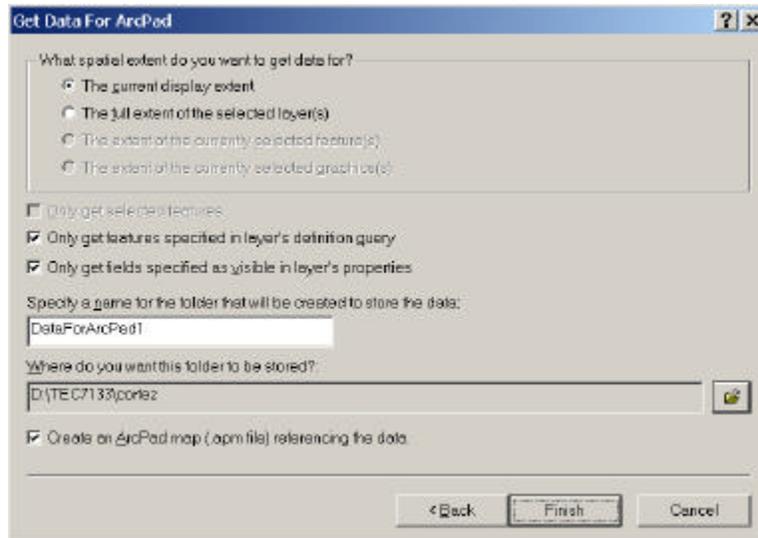


4. Click on the **Get Data for ArcPad**  button.
5. In the *Get Data for ArcPad* dialog, click on **Select All**. This checks all of the layers in your map document.

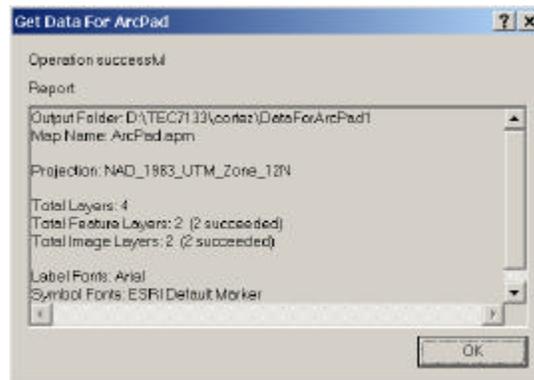


6. Click **Next**.

- Click on the folder icon to change the path of where the new folder is going to be created. Specify `D:\TEC7133\Cortez` as the location to store the new folder. Go ahead and leave the default new folder name (`DataforArcPad1`).



- Click **Finish**.
- The process will take a few minutes. The image files are being encoded to the MrSid format. Once the process is finished a report window will appear.



- Notice the *Symbol Fonts*. The ESRI Default Marker symbol font is being used. Click **OK** to dismiss the report window.
- Close ArcMap and save your changes. Congratulations! Your GIS data is now ready to be put into your handheld device and used with ArcPad.

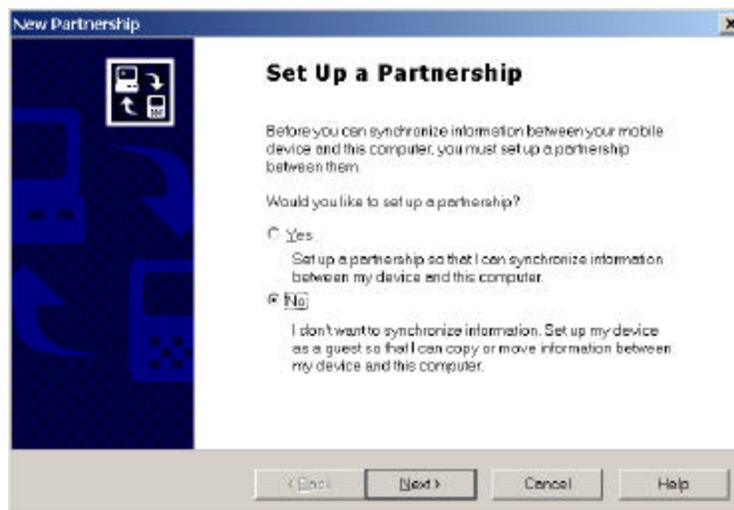
PLEASE STOP HERE !

Transferring files to your handheld device

The primary software used to connect Windows CE devices to your PC is called ActiveSync. There are 2 ways to setup a connection between your handheld device and your PC. One method is to setup a partnership so your will automatically synchronize the data with your PC. Another method is to simply establish a guest relationship. A guest relationship only lasts as long as the two computers are connected. You can copy, move, drag and drop files back and forth between your mobile device and your PC. It is highly recommended to use the guest method.

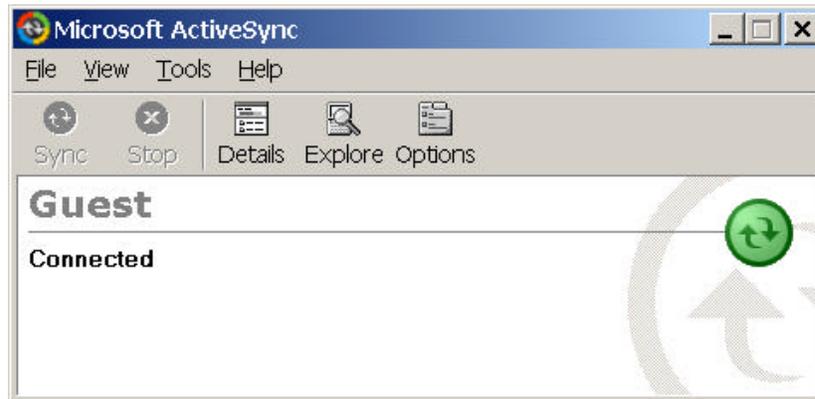
NOTE: This exercise was developed using ActiveSync version 3.7

1. Put your mobile device onto the cradle.
2. ActiveSync should automatically detect your device. If not, take device off the cradle and try again.
3. Check **No** when asked to setup a partnership.



4. Click **Next**.

5. You are now connected as a *Guest*. Your screen should match the example below.

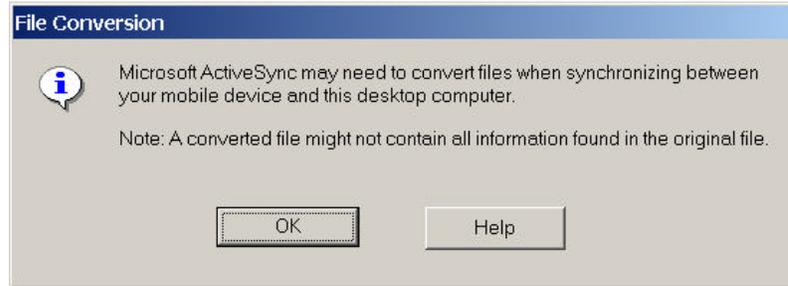


6. Click on the **Explore**  button.
7. Double click on **My Pocket PC** (iPAQ) or **My Computer** (GeoCE).
8. Double click on the *My Documents* folder.

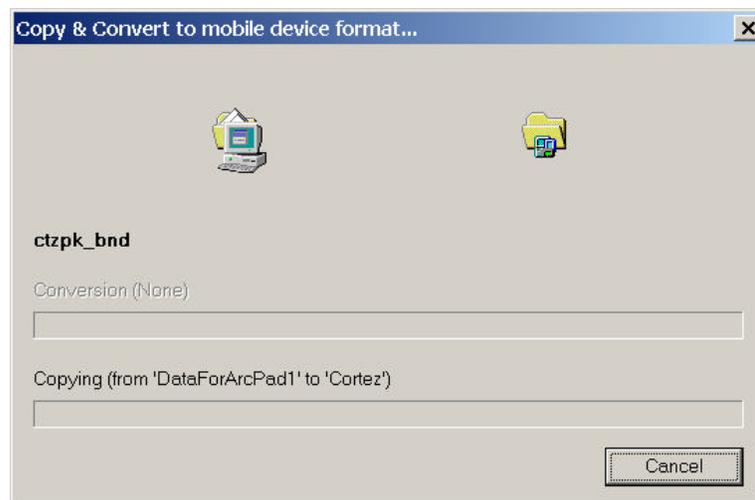
NOTE: Trimble GeoCE users, double click on *Disk* and then *My Documents*. This will store you files on the device's hard disk.

9. From the **File** menu, choose **New Folder**.
10. Type **Cortez** for the name of the new folder.
11. Double click on the *Cortez* folder.
12. Launch *Windows Explorer* (Start Menu...Programs...Windows Explorer).
13. Navigate to the `\\TEC7133\Cortez\DataforArcPad1` folder.
14. From the **Edit** menu, choose **Select All**.
15. From the **Edit** menu, choose **Copy**.
16. Close or minimize Windows Explorer and return to the Mobile Device Explorer window.
17. From the **Edit** menu, choose **Paste**.

18. Click **OK** if warned that some files may need to be converted.



19. The files are transferred to your mobile device. The transfer may take a few minutes.



20. Congratulations you have just transferred your GIS data to your handheld device!

PLEASE STOP HERE !

Opening an ArcPad map file on your mobile device

1. Remove your mobile device from the cradle.
2. Launch ArcPad.
3. From the *Main Toolbar*, click the **Open Map**  button. Navigate to the folder named *My Documents\Cortez* and tap the *arcpad.apm* file.
4. The ArcPad map opens. Ensure the four files you prepared using ArcPad Tools for ArcGIS are present in your map.

NOTE: GeoCE users, you may need to tap the **Refresh**  button in order for the image files to be displayed.

5. Identify and list the discrepancies between the look of the ArcPad map file and the original ArcMap map document.

Challenge Topics

1. Change the point symbol for NTC so it matches the symbol used in ArcMap. Why wasn't the same symbol used for this feature?
2. Change the label for the NTC layer from "BLM National Training Center" to "NTC". Ensure this label is automatically turned off when zoomed in at a display scale of less than 1:10000.
3. Create a label for Cortez Park. Use the same size and font as the "NTC" label. Ensure this label is automatically turned off when zoomed in at a display scale of less than 1:10000

EXTRA CREDIT

Create a "new map" and add the four layers you just prepared for use in ArcPad. Notice the warning regarding "missing spatial reference" information for these 2 image files. Assign spatial reference information for these 2 files so this warning doesn't appear when you add these layers.

PLEASE STOP HERE !

Creating MrSID files from Imagery using ArcToolbox

ArcPad displays imagery best if your files are in the MrSID format. All users of ArcGIS can encode individual, uncompressed rasters smaller than 50 MB. The 50 MB size rule will be evaluated as follows: Image Width * Image Height * Number of Bands **cannot be greater than 50 million.**

If you purchase the extension from Lizard Tech, then your limit is 500 MB with the added ability to mosaic images.

In this exercise you will take a B&W DOQQ which is currently in the TIF file format and encode into the MrSID format using ArcToolbox. This method is preferable to ArcPad Tools when you have multiple adjacent images and/or you exceed file size thresholds. This method allows you to set the compression level desired.

1. Open up ArcToolbox.
2. Click on **Conversion Tools ...Export from Raster...Raster to MrSID.**
3. Click on the folder button just to the right of *Input Raster*.
4. Navigate to the `\TEC7133\Cortez` folder.
5. Select the *glendale_ne.tif* file (file size is ~49 Mb).
6. Change the compression ratio to 20.
7. Specify `\TEC7133\Cortez` as the folder and type **glendale20** for the *Output Raster* name.
8. Click **OK**. The encoding takes a few minutes.
9. Congratulations you have successfully created a MrSID file from a DOQ that was in TIF format!

NOTE: Batch processing can only be done with the MrSID extension.

Challenge Topic

Encode the same file at a compression ratio of 100:1 and name it *glendale100.sid*. What are the file sizes for the *glendale100.sid* file and *glendale20.sid*? Transfer these two files to your handheld device and compare any differences between their display times and image quality.

Section 4

Using an Applet to Create Basic Forms

Section 4 Objectives:

At the end of this section, you will be able to:

- Set ArcPad path options
- Create new layers in ArcPad
- Install an applet
- Create a form using the ArcPad Form Creation Wizard

Using an Applet to Create Basic Forms

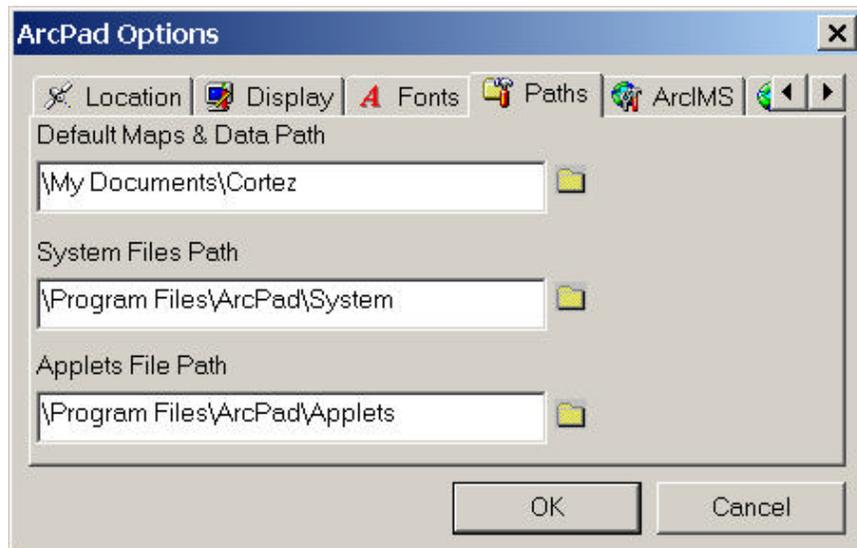
In this section you will learn how to set path options, create new layers, install an applet and build a basic form for data collection. The forms are created using an applet called the *ArcPad Form Creation Wizard*.

Set your path options

To streamline adding data you can specify the location of your maps and data from the *Paths* tab in the *ArcPad Options* dialog. This is also where you specify the location that ArcPad looks for system files, applets and/or extensions.

1. Open ArcPad.
2. Tap the *Tools*  button.
3. Scroll over and tap the *Paths* tab.
4. In the *Default Maps & Data Path* section, click on the folder and specify the path to your Cortez data. See [iPAQ Pocket PC](#) example below.

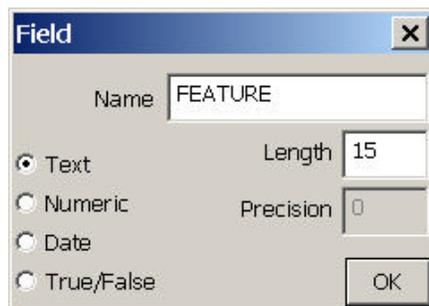
NOTE: GeoCE users should specify: `\Disk\My Documents\Cortez`



5. Take note of the *Applets File Path* section. You will be copying applet files to this location later in this section.

Create a new layer

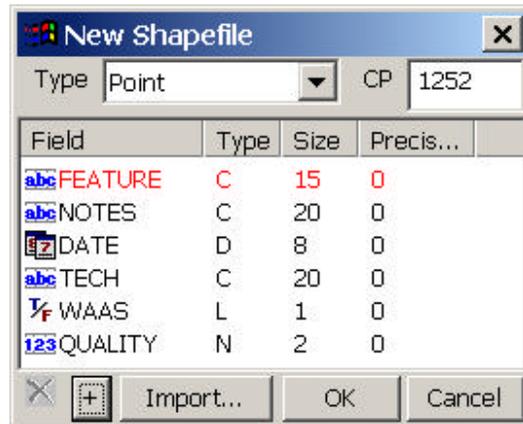
1. On your handheld device, open the *ArcPad.apm* file located in your *My Documents\Cortez* folder.
2. From the drop down next to the *Open Map* icon, select **New Layer**.
3. Ensure **Point** is selected in the *Type* section and tap on the **Add Field**  button to create a new field.
4. Enter FEATURE for the name and assign 15 for the length. Ensure *Text* is checked for the type of field to be added. See example below. Tap **OK** when finished setting the field parameters.



The screenshot shows a dialog box titled "Field" with a close button (X) in the top right corner. The "Name" field contains the text "FEATURE". Below the name field are four radio button options: "Text" (which is selected), "Numeric", "Date", and "True/False". To the right of these options are two input fields: "Length" with the value "15" and "Precision" with the value "0". An "OK" button is located at the bottom right of the dialog box.

5. Add a *Text* field named NOTES with a length of 20.
6. Add a *Date* field named DATE.
7. Add a *Text* field named TECH with a length of 20.
8. Add a *True/False* field named WAAS.
9. Add a *Numeric* field named QUALITY with a length of 2, and a precision of 0.

10. When finished adding all of the above fields your screen should match the example below.



11. Tap **OK** in the *New Shapefile* dialog and navigate to the *My Documents\Cortez* folder and assign the name *structures*. Tap **Save**.
12. Create a new Polyline layer named *Trails*. Use the same fields and parameters as above but delete the *FEATURE* field and add a field named *SURFACE*. The *SURFACE* field should be a *Text* field with a length of 2. Store this layer in the same location as *structures*.
13. Create a new Polygon layer named *Parking*. Use the same fields and parameters as above but delete the *FEATURE* field and add a field named *SURFACE*. The *SURFACE* field should be a *Text* field with a length of 2. Store this layer in the same location as *structures*.
14. Save your map and close ArcPad.

PLEASE STOP HERE!

Install the applet

The *ArcPad Form Creation Wizard* is available from the ESRI ArcScripts page (<http://arcscripts.esri.com/>). This applet is provided on your course CD as well.

1. Open Windows Explorer. Navigate to the `\TEC7133\applets\form_wizard` folder.
2. Select the *formwizard.apa* and *formwizard.vbs* scripts. Copy these files and paste into the *Program Files\ArcPad\Applets* folder located on your handheld device.

NOTE: Path for GeoCE users: `\Disk\Program Files\ArcPad\Applets`

3. Launch ArcPad and ensure a new toolbar is added to your interface.



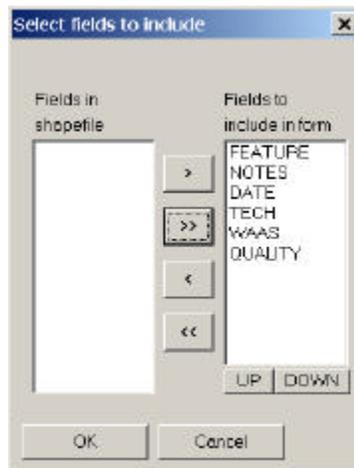
PLEASE STOP HERE!

Copy lookup table to handheld device

1. Copy the \\TEC7133\Cortez\ptfeats.dbf file from your PC to the *Cortez* folder on your handheld. This file will be specified as a lookup table in the next section when building your form.

Build the form using the Wizard

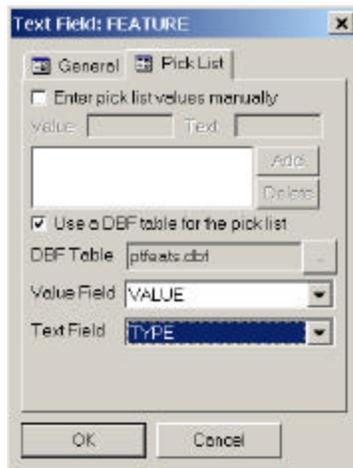
1. On your handheld device, open the *ArcPad.apm* file located in *Cortez* folder.
2. Tap the **Layer form creation wizard**  button.
3. Select *structures.shp* from the current map and tap **OK**.
4. Tap the move all fields  button to include all fields on the new form.
5. Your screen should match the example below. Tap **OK** when finished.



6. For field number 1, the FEATURE field, put a check next to “*This field is a required field*”.
7. Tap the **Pick List** tab.
8. Check “*Use a DBF table for the pick list*”.
9. Click the *browse file*  button. Select the *ptfeats.dbf* file located in the *Cortez* folder.

10. Specify **Value** for the Value field and **Type** for the *Text field*. Tap **OK** when finished specifying the fields.

NOTE: The value field contains the actual value that will be put into the database and the text field contains the text that the user sees when using the form.



11. You are now presented with field number 2, the NOTES field. Since we are not going to specify a default value, pick list or make this a required field, tap **OK**.

12. For field number 3, the DATE field, check “*Use the current date as the default*”. Also check “*Display this field as read-only*”. Tap **OK**.

13. For field number 4, the TECH field, type your last name in the default value section. Also make this field read-only. Tap **OK** when finished.



14. For field number 5, the WAAS field, specify the default value as *False* if setting up the form for the TeleType GPS and specify *True* if setting up the form for the GeoCE. Tap **OK**.
15. For field number 6, the QUALITY field, click on the *Pick List* tab.
16. Check “*Enter picks lists manually*”.
17. Type **1** in the *Value* section. Type **3 or less** in the *Text* section. Tap **Add**.
18. Type **2** in the *Value* section. Type **6 or less** in the *Text* section. Tap **Add**.
19. Type **3** in the *Value* section. Type **No quality rules** in the *Text* section. Tap **Add**.



20. Tap the *General* tab. Specify **2** as the default value. Tap **OK**.
21. Click **Yes** when asked to reload the shapefile using the new form.



22. Tap the *Layers*  tool.
23. Make the layer editable by putting a check in the edit column for the *structures.shp* layer.
24. Select the **Point**  tool and click in your map display to add a point feature. Examine and populate your form. Click **OK**.
25. On the *Edit* toolbar, click on the drop down arrow next to the **Properties** button  and select *Delete Feature* to remove the feature you just added. Click **Yes** when asked if you want to delete.
26. Create forms for the *Trails.shp* and *Parking.shp* layers. Ensure the SURFACE field is at the top of the form and specified as a required field. Use a pick list for the this field and assign the following parameters:

<u>TEXT</u>	<u>VALUE</u>
Asphalt	A (specify as the default value)
Concrete	C
Dirt/gravel	D
Grass	G
Other	O

Use the same field parameters as the *structures.shp* for all other fields. Be sure to test each form!

Section 5

Planning GPS Data Collection

Section 5 Objectives:

At the end of this section, you will be able to:

- Utilize Trimble's Planning software for planning GPS data collection

Planning GPS Data Collection

Trimble has made available free and easy to use GPS planning software. The *Trimble Planning* software allows you to determine PDOP conditions for GPS data collection at any location you choose. This information is applicable to all GPS devices, not just Trimble units. **The installation files for the Trimble Planning software is provided on the TEC7133 CD-ROM.** You can also download this software from a link at the following URL:

<http://www.trimble.com/planningsoftware.html>

In this exercise you will use the Trimble's *Planning* software to plan GPS data collection for the local area using today's date.

NOTE: This exercise was developed using *Planning* version 2.7.

Step 1- Load Updated Almanac File

1. First we need to download the latest almanac file from Trimble. For this exercise we will utilize an almanac provided by Trimble on the web. Open Internet Explorer and navigate to the following URL:

<http://www.trimble.com/gpsdataresources.html>

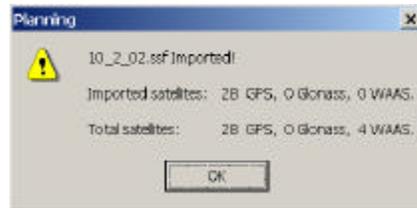
NOTE: If you have a Trimble GPS, you could use one of your current SSF files instead of going to the web.

2. Click on **Current Ephemeris Data**. Select **Save Target As**. Navigate to the *d:\tec7133\almanac* folder and change the name of the file to *currentdate.ssf*. Click **Save**.

NOTE: Changing the name is optional. However, this is good file management. Almanac files become outdated and are generally good for only about 30 days. Therefore, by using the current date as the file name, you now know when you downloaded the almanac from Trimble.

3. Open the Trimble Planning software (*Start>>Programs>>Trimble Office>>Utilities>>Planning*).
4. We need to clear the existing almanac file. From the **Almanac** menu, choose **Clear**. Select **Yes** when asked if you really want to clear the almanac file.
5. From the **Almanac** menu, choose **Import** and click **SSF**.

6. Navigate the *d:\tec7133\almanac* folder and select *currentdate.ssf*. Click **Open**. Click **OK** to dismiss the *Planning* dialog that reports the number of imported satellites.



7. You now need to save this almanac into the Trimble Total Control format. From the **Almanac** menu, choose **Save**. Name the file *currentdate.alm* and store in same folder as above (*d:\tec7133\almanac*).
8. Now you can load this new almanac into Trimble Planning. From the **Almanac** menu, choose **Load**. Specify the almanac file you just saved in the previous step.

Step 2 – Assign GPS Data Collection Parameters

1. From the **File** menu, choose **Station**. The *Station Editor* dialog appears.
2. Click the **City** button. Now select *Phoenix, AZ* from the list of cities and click **Select**.
3. Click on the **Time Zone** button and apply the correct local time.

- Since you will only be collecting GPS data today between 8am and 5pm, ensure the following parameters are entered into the *Time* section of the dialog.

Start Date: current date
Start Time: 08:00
Duration: 9
Interval: 10

The *Station Editor* dialog should be similar to the example below.

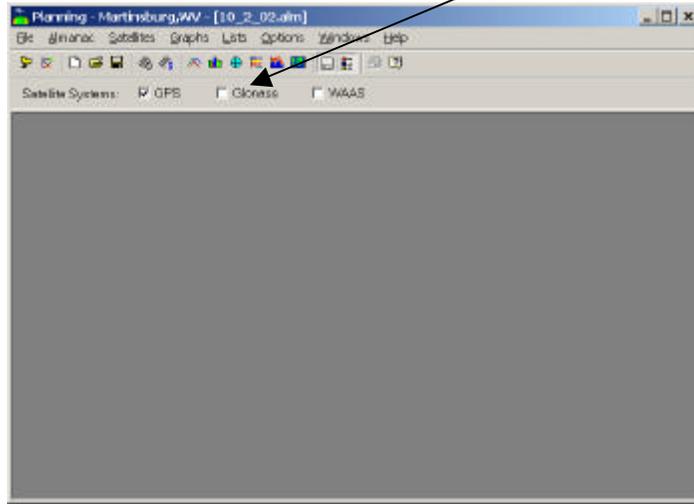
The screenshot shows the 'Station Editor' dialog box with the following settings:

- Station Name:** Phoenix, AZ
- Position:**
 - Latitude: N 33 27
 - Longitude: W 112 4
 - Height: 0 [m]
 - Elevation Cutoff: 10
- Time:**
 - Start Date: 11/18/2003
 - Start Time: 08:00
 - Duration: 9 [h]
 - Interval: 10 [min]
- Time Zone:**
 - (GMT-07:00) Arizona
 - DST
 - Difference GMT: -6.0 [h]

Buttons on the right side include: OK, Cancel, Apply, Delete, Obstacles..., Map..., City..., Today, and Time Zone...

- Click **OK** when finished.

6. Since you will not be using a GPS device that utilizes Glonass satellites, uncheck the box next to Glonass.



Step 3 – Examine Results

1. From the **Graphs** menu, choose **Number of Satellites**.
How many satellites will be visible at 1:00 pm (13:00)? _____
2. From the **Graphs** menu, select **DOP** and choose **DOP – Position**.
At what time is PDOP generally the lowest? _____
What is the approximate PDOP value at 9:00 am (09:00) ? _____
3. From the **Lists** menu, select **DOP Values**.
What is the exact PDOP value at 9:00 am (09:00)? _____
4. If you wanted to keep PDOP less than 3, which time of day would you avoid?

5. From the **Graphs** menu, select **Sky Plot**.
Why should you avoid facing north when collecting GPS data?

Challenge Exercise

Now that you are familiar with using Trimble Planning software, identify PDOP conditions near your office.

Use the following parameters:

Location: City nearest your office

Elevation cutoff: 10 degrees

Start Date: Any date within 30 days of current almanac file

Start Time: 08:00

Duration: 8

Interval: 10

Time Zone: Set local time

When is PDOP the lowest? _____ PDOP value _____

When is PDOP the highest? _____ PDOP value _____

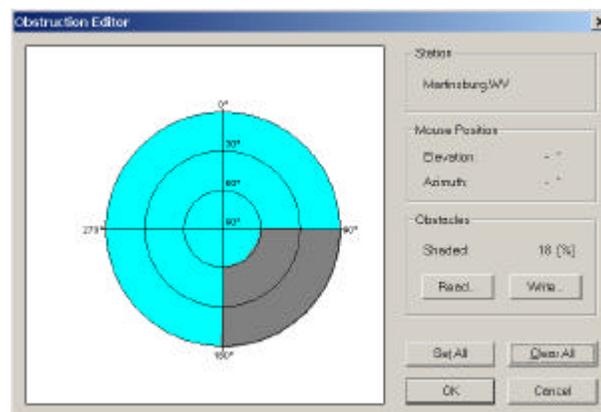
How many satellites are visible at 12 noon? _____

EXTRA:

You need to collect a nest site along the edge of a steep cliff face. Therefore, satellite visibility will be blocked for a portion of the sky. The area to be blocked is the entire SE (90 to 180 azimuth) sky from an elevation of 60 degrees down to the horizon. Use the *Obstruction Editor* to set these parameters. If necessary, access the *Help Topics* to determine how.

List the range of times that represent the best window of opportunity to collect this nest site location? _____

What is the PDOP during this time frame? _____



Section 6

Configuring GPS Devices with ArcPad

Section 6 Objectives:

At the end of this section, you will be able to:

- Configure GPS devices to ArcPad

Configuring GPS Devices with ArcPad

Since each GPS device may have a unique configuration, there are really no standard procedures for configuring GPS devices with ArcPad. However, an outline of the four basic steps are given below:

- ?? Determine cables and hardware required for connecting GPS device.
- ?? Connect the GPS device to the mobile device.
- ?? Set the configuration of the GPS device.
- ?? Set the GPS options in Arcpad.

Procedures for configuring several commonly used GPS devices with ArcPad are provided below.

TeleType GPS – World Navigator

You do not need to install the TeleType software in order to configure the TeleType GPS with ArcPad. However, if you have a TeleType with WAAS capability, you need the Advanced GPS Utility software utility to turn WAAS on and off. Copy the *WaasCE.exe* file to your handheld. Double tap this file to run the utility. This utility allows you to toggle WAAS on and off. You can also change NMEA sentence set output using this utility.

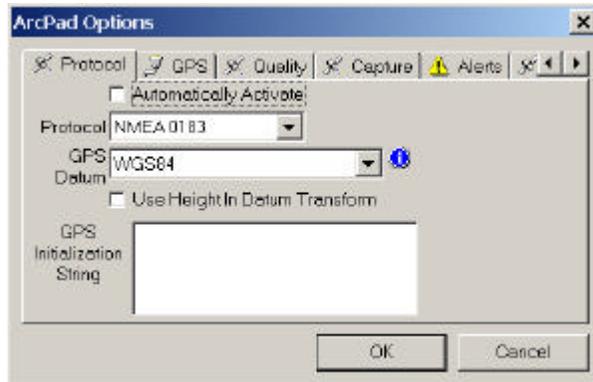
Use the following instructions for configuring the TeleType GPS with ArcPad using a Compaq iPAQ Pocket PC mobile device.

1. Connect your GPS device to the iPAQ.
2. Open ArcPad.
3. Tap the **Tools**  icon to open up the *GPS options* dialog.

4. Select the **Protocol** tab and ensure the following protocol is set:

Protocol: **NMEA 0183**

GPS Datum: **WGS84**



NOTE: The TeleType World Navigator always outputs GPS data using WGS84.

5. Tap the **GPS** tab and ensure the following parameters are set.

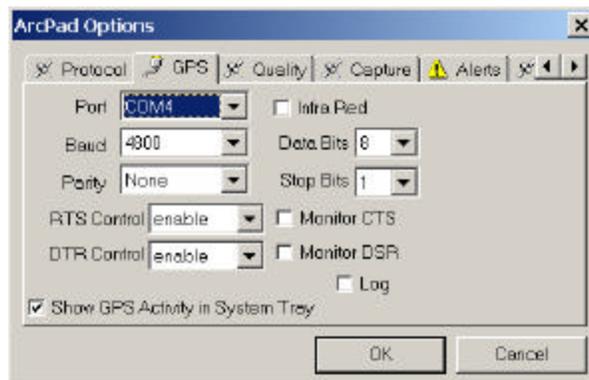
Port = **Com4**

Baud = **4800**

Parity = **None**

Data Bits = **8**

Stop Bits = **1**



NOTE: If using the dual expansion pack or are having trouble finding correct COM port number, consider using the **FindGPS 1.0.5** extension. See yellow pages included at end of chapter on using this utility.

Trimble GeoCE running GPSCorrect

Step 1 - Configure the GPS device

1. Open GPSCorrect (tap **F1** along right side of window).
2. Change the display to *Setup*.
3. Tap on *Logging Settings*.
4. Turn Log GPS to SSF to **ON**.
5. For Data Type, choose **SuperCorrect**. This allows you to post-process data that is collected using real-time such as WAAS.

Step 2 - Configure ArcPad

1. Set the following parameters in the *GPS Options* dialog.

Protocol Tab

Protocol: **Trimble GPSCorrect**
Datum: **WGS84**

GPS Tab

Port = **Com3**
Baud = **9600**
Parity = **Odd**
Data Bits = **8**
Stop Bits = **1**

Hardware for PLGR, Garmin and various Trimble devices

If you are going to connect a PLGR, Trimble, or any Garmin to a Compaq iPAQ (models 3100, 3600 and 3700 series) you need to purchase a Compaq RS-232 serial cable. This cable costs around \$30. You can obtain this item from CDW-G (www.cdwg.com). The Compaq part number is 236251-B21. This cable is required in addition to the PLGR/Garmin to PC cable.

Please be aware that the cable connection to the iPAQ is not very good. The cable becomes disconnected quite easily. A solution to the problem is ordering a Surveyor's Window Case from XYZ Works (www.xyzworks.com). This case costs around \$115. **If you purchase this item you do not need the RS-232 serial cable mentioned above.**

NOTE: *The Surveyor's Window Case DOES NOT work with the dual expansion pack.*

Garmin GPSTMap76S

1. Configure the GPS device. Set the serial data format to **NMEA**.
From Main Menu, choose*Setup*....*Interface*...*Serial Data Format*.

NOTE: The default setting is Garmin.

2. In ArcPad, set the following parameters in the *GPS Options* dialog:

Protocol: **NMEA**

Datum: **WGS84**

Port = **Com1**

Baud = **4800**

Parity = **None**

Data Bits = **8**

Stop Bits = **1**

NOTE: These settings should work with most Garmin GPS devices.

PLGR +96

1. Configure the GPS device. Set the serial output on PLGR to Custom. Select NMEA as the output. To change serial output select *Setup* menu. Move to the 6th page and change *Serial* to **Custom**. Move to the next page and change *Serial OUT* to **NMEA**. Move to next page and add following NMEA sentence sets: GGA, GLL, GSA , GSV, and VTG.
2. In ArcPad, set the following parameters in the *GPS Options* dialog:

Protocol: **NMEA**

Datum: **WGS84**

Port = **Com1**

Baud = **9600**

Parity = **None**

Data Bits = **8**

Stop Bits = **1**

Trimble Pathfinder Pocket

1. Download Trimble's Pathfinder Controller software which is free and available at: www.trimble.com/pathfindercontroller.html
2. Open Pathfinder Controller software, ensure *Port B* is set to **COM 1** and the *Protocol* is set to **TSIP**.
3. In ArcPad, set the following parameters in the GPS Options dialog:

Protocol: **TSIP**
Datum: **WGS84**

Port = **Com1**
Baud = **9600**
Parity = **None**
Data Bits = **8**
Stop Bits = **1**

OPTIONAL: You can use NMEA protocol instead of the Trimble proprietary protocol (TSIP). This protocol must be specified in Pathfinder Controller software. Also, for NMEA settings, check the GGA, VTG, GLL, GSA, GSV, RMC, ZDA sentence sets in Pathfinder Controller.

GeoExplorer 3

1. Configure GPS device. From the *SYS* menu page select *Setup* tab. Select *Configurations* and then choose *COMMS*. Use the following settings:

NMEA Output: **Serial Clip**
Port Settings:
Input Baud Rate: **38400**
Output Baud Rate: **38400**
Parity = **None**
Data Bits = **8**
Stop Bits = **1**

2. In ArcPad, set the following parameters in the *GPS Options* dialog:

Protocol: **NMEA**
Datum: **WGS84**

Port = **Com1**
Baud = **38400**
Parity = **None**
Data Bits = **8**
Stop Bits = **1**

Section 7

Collecting GPS Data with ArcPad

Section 7 Objectives:

At the end of this section, you will be able to:

- Create a new shapefile layer
- Set GPS quality and capture options
- Collect point, line and polygon features in the field using ArcPad

Collecting GPS Data with ArcPad

Once you have your GPS device configured, you are ready to start collecting data in ArcPad using your GPS. What really makes ArcPad nice, is that since you capture data directly into a shapefile, you eliminate the step of converting the raw GPS data into a format compatible with your GIS.

There are several new shapefile types that you may not be familiar with. Here is a list of all the shapefile types that can be created in ArcPad and a description for each.

Shapefile Type	Description
Point	2D point shapefile that only stores X and Y coordinates
PointZ	3D point shapefile that stores X, Y and Z coordinates
PointM	2D point shapefile that stores X,Y and M (measure value)
Polyline	2D polyline shapefile that only stores X and Y coordinates
PolylineZ	3D polyline shapefile that stores X, Y and Z coordinates
PolylineM	2D polyline shapefile that stores X,Y and M (measure value)
Polygon	2D polygon shapefile that only stores X and Y coordinates
PolygonZ	3D polygon shapefile that stores X, Y and Z coordinates
PolygonM	2D polygon shapefile that stores X,Y and M (measure value)

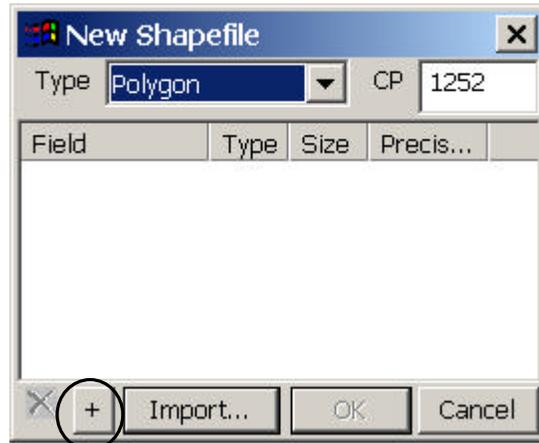
Creating a layer (shapefile) in ArcPad

In this exercise you will create a new habitat layer for use at NCTC.

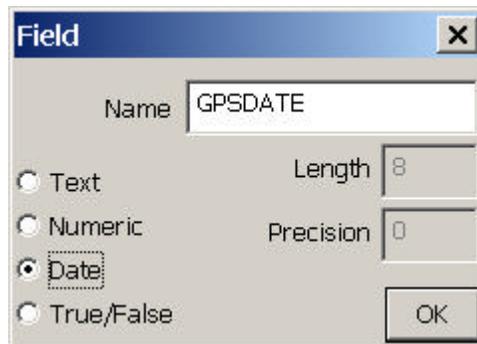
1. Open ArcPad.
2. Tap the dropdown arrow to the right of the Open Map  button.
3. Tap **New Layer**.
4. Choose the polygon shapefile from the *Type* dropdown list.



5. Tap the + button to open the *Field* dialog box.



6. Define the first field for you new shapefile's table. Enter **GPSSDATE** in the Name section. Check **Date** for field type. Click **OK** when finished.



7. Tap the + button to open the *Field* dialog box. Use the following parameters to define the second field. Click **OK** when finished.

NAME: **GPSTECH**
TYPE: **TEXT**
LENGTH: **25**

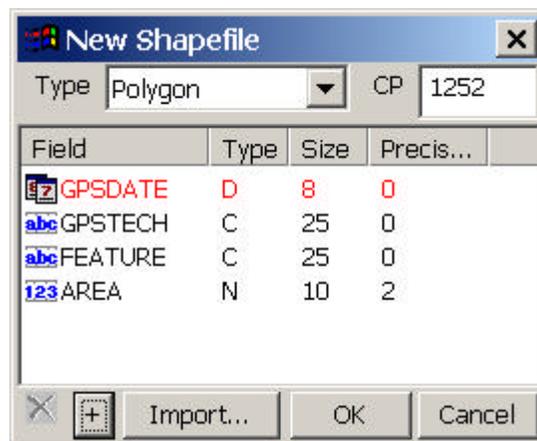
8. Tap the + button to open the *Field* dialog box. Use the following parameters to define the third field. Click **OK** when finished.

NAME: **FEATURE**
TYPE: **TEXT**
LENGTH: **25**

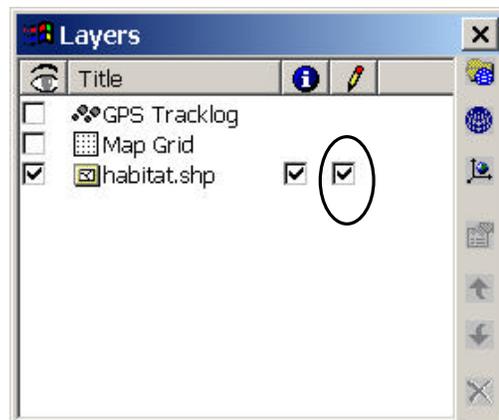
9. Tap the + button to open the *Field* dialog box. Use the following parameters to define the fourth field. Click **OK** when finished.

NAME: **AREA**
TYPE: **NUMERIC**
LENGTH: **10**
PRECISION: **2**

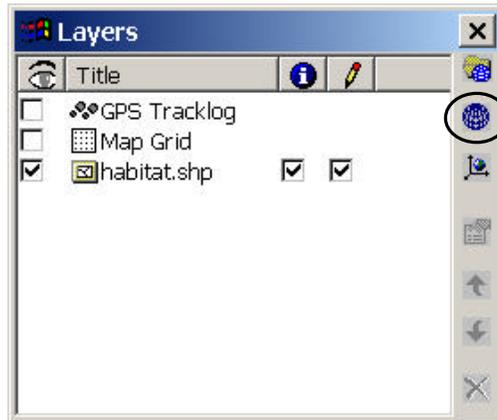
10. The New Shapefile dialog box should match the example below. Click **OK** when finished.



11. You will be presented with a dialog box. Store the file in the TEC7133 folder and name the file HABITAT.
12. Tap the **Layers** button. Notice the new layer is already in edit mode.

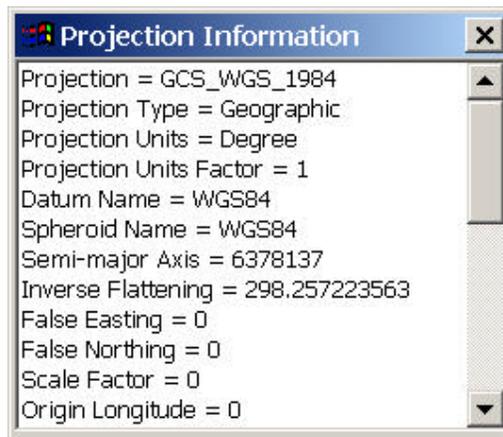


13. Tap the **Projection Information**  button.



14. ArcPad defaults to the Geographic Coordinate System referenced to the WGS84 datum (GCS_WGS_1984).

NOTE: If you would have added a layer that had a *.prj file associated with it before creating this new layer, then ArcPad would use the projection associated with that layer.

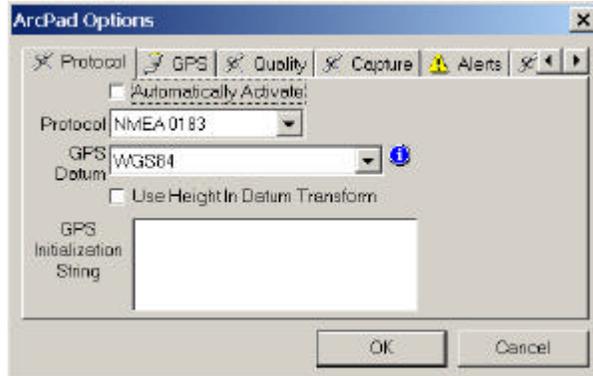


15. Tap the **Define Projection**  button. Navigate to the *My Documents\prjs* folder and select the *NAD83UTM18.prj* file.
16. Tap the **Projection Information**  button to verify the new projection settings.

Setting GPS Quality and Capture Options

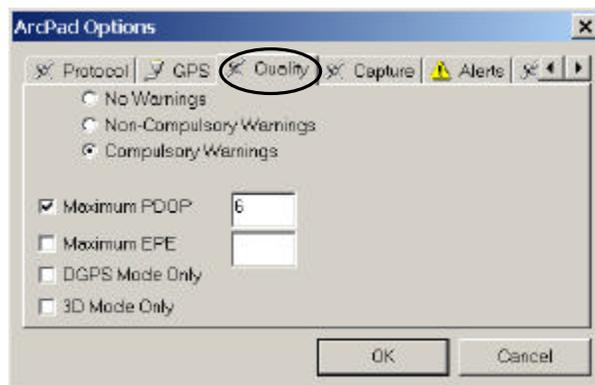
Another nice feature of ArcPad is the ability to specify quality and capture options that meet your projects accuracy requirements. In this exercise, you will set GPS data capture and quality options before collecting habitat features on NCTC with ArcPad and a GPS device.

1. Tap the **Tools** button to open the *ArcPad Options* dialog.



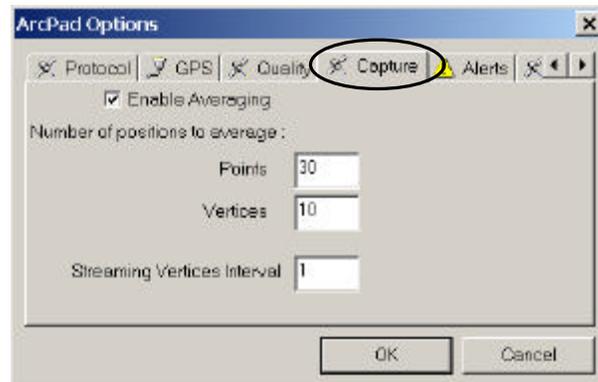
2. Tap the **Quality** tab. Put a check next to *Compulsory Warnings*. Now, set the *Maximum PDOP* to a value of **6**. Your dialog should match the example below.

NOTE: By checking compulsory warnings, you cannot collect GPS data that exceeds a PDOP value of 6. If you had checked non-compulsory, then you would be warned if PDOP was above 6 but still having the option to continue collecting data.



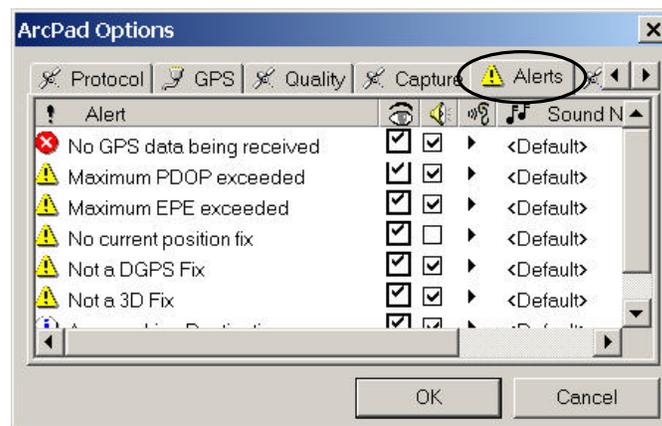
3. Tap the **Capture** tab. Put a check in *Enable Averaging*. For the number of positions to average enter **30** for *Points* and **10** for *Vertices*. Leave the default setting of **1** for the *Streaming Vertices Interval*.

NOTE: An average position usually is more accurate than one single position.



4. Tap the **Alerts** page. By default all warnings are checked. Extend the first column so you read all of the alerts. Tap the column divider, hold and drag your stylus to the right to extend the column so you can read all of the various alerts. Click **OK** when finished.

OPTIONAL: Uncheck the audio sound for the *No Current Position* alert. This alert can be rather annoying when waiting for the GPS to startup and obtain a positional fix.



5. You are now ready to begin collecting data.

Steps for Creating Point Features with a GPS

1. Select a point layer for editing in the *Layers* dialog.
2. Activate your GPS.
3. Monitor the *GPS Position Window* until you have a positional fix that is within the quality options you have specified for the project.
4. Tap the **GPS Point**  button on the *Edit/Drawing* toolbar to create a point feature.
5. Type in the attributes for the new feature.

Methods for Capturing Line and Polygon Features

There are two methods that can be used when capturing vertices for line and polygon features.

- ?? Add GPS Vertex 
- ?? Add GPS Vertices Continuously 

NOTE: The **Add GPS Vertex** method allows you to collect each vertex individually and is much more accurate especially when averaging is used. The **Add GPS Vertices Continuously** method is more suited for mapping trails and roads from a moving vehicle.

Steps for Creating Line Features with a GPS

1. Select a line layer for editing in the *Layers* dialog.
2. Activate your GPS.
3. Monitor the *GPS Position Window* until you have a positional fix that is within the quality options you have specified for the project.
4. Tap the **Add Vertex**  button to capture a single vertex or tap the **Add GPS Vertex Continuously**  button to capture streaming vertices.
5. Tap the **Polyline**  button when you are ready to complete the capture of the polygon feature.
6. Type in the attributes for the new feature.

TIP: You can also record a point feature while recording a line feature.

Steps for Creating Polygon Features with a GPS

1. Select a polygon layer for editing in the *Layers* dialog.
2. Activate your GPS.
3. Monitor the *GPS Position Window* until you have a positional fix that is within the quality options you have specified for the project.
4. Tap the **Polygon**  button to start capturing a polygon feature.
5. Tap the **Add Vertex**  button to capture a single vertex or tap the **Add GPS Vertex Continuously**  button to capture streaming vertices.
6. Tap the **Polygon**  button when you are ready to complete the capture of the polygon feature. The last vertex will automatically connect to your first vertex and close the polygon.
7. Type in the attributes for the new feature.

TIP: You can have one point, one line and one polygon layer all selected for editing in the *Layers* dialog.

Creating a Tracklog Shapefile in ArcPad

ArcPad stores a tracklog in shapefile format. The points created are displayed in the map as a red line. The GPS Tracklog are always captured in latitude and longitude using WGS84. The tracklog is projected on the fly to the current projection of the ArcPad map. You cannot attribute this shapefile, however, numerous coordinate and data quality attributes are automatically collected for each point.

When using the **Add Layer** tool to add the tracklog shapfile, ArcPad displays the the tracklog as points. In this case, it does not perform on-the-fly projection of the tracklog's point data.

To toggle the tracklog on and off, choose GPS Tracklog from the dropdown to the right of the GPS Position Window  icon.

Properties for the tracklog can be set as well. Tap the *Layers* button to open the *Layers* dialog. Select the *GPS Tracklog* layer and tap the **Layer Properties** button.

Section 8

Metadata

Section 8 Objectives:

At the end of this section, you will be able to:

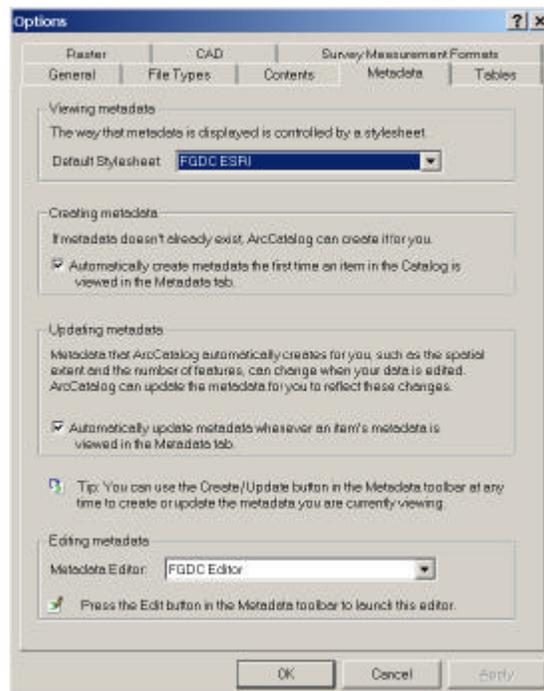
- Create a metadata template
- Import a metadata template
- Populate metadata records

Metadata

ArcCatalog provides wonderful tools for creating metadata. What is metadata? Simply put, metadata is “data about data”. All federal agencies are required to produce metadata for their spatial data layers. In this section you learn how to create a metadata template, import the template and populate critical fields for the GPS data you previously collected in the field.

Create a metadata template

1. Open ArcCatalog (Start...Programs...ArcGIS...ArcCatalog).
2. Click on the **Connect to Folder**  button.
3. Navigate to the `\TEC7133\Cortez` folder and click **OK**.
4. From the **Tools** menu, choose **Options**.
5. Click on the **Metadata** tab. Ensure the *Creating Metadata* and *Updating Metadata* sections are checked so the creation and updates of metadata are performed automatically. Also, ensure the **FGDC ESRI** stylesheet and **FGDC ESRI** stylesheet and *FGDC Editor* are specified in the appropriate sections. Click **OK** when finished.



6. Click on the plus sign  next to the \TEC7133\Cortez folder to expand this folders contents in the catalog tree.
7. We are going to use the *structures.shp* file to create our template. Select this file in the catalog tree. NOTE: Any layer file can be used to create the template.
8. Click on the **Metadata** tab. Now, since ArcCatalog has been set to automatically create metadata, the program will extract as much information as it can from the shapefile and generate a metadata file. The metadata file is an XML (Extensible Markup Language) file and placed in the same folder as the shapefile.



9. Click on the **Spatial** tab in the display window. Notice the horizontal coordinate system and bounding coordinates are automatically determined for you.
10. Click on the **Attributes** tab. Notice the list of attributes (field names). Click on the *Feature* attribute. It expands and displays the field type parameters that you previously assigned in ArcPad.

FEATURE

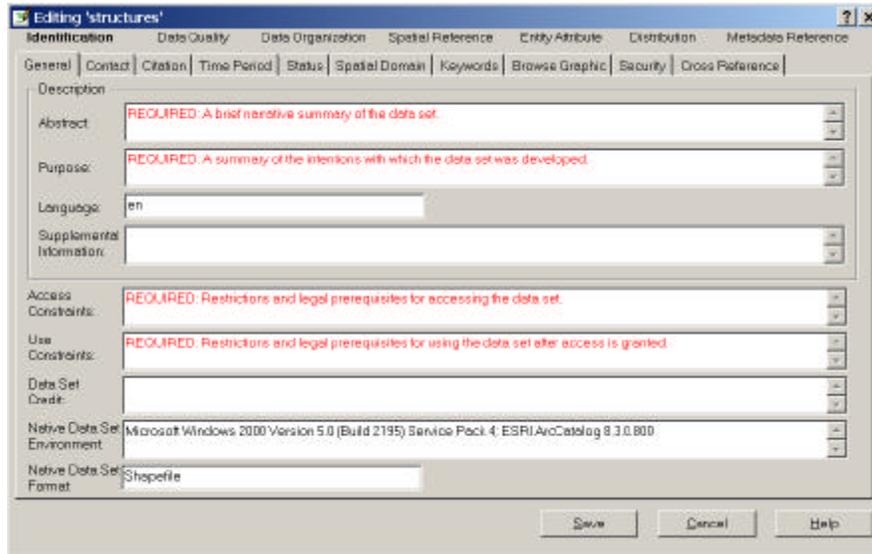
Alias: FEATURE

Data type: String

Width: 15

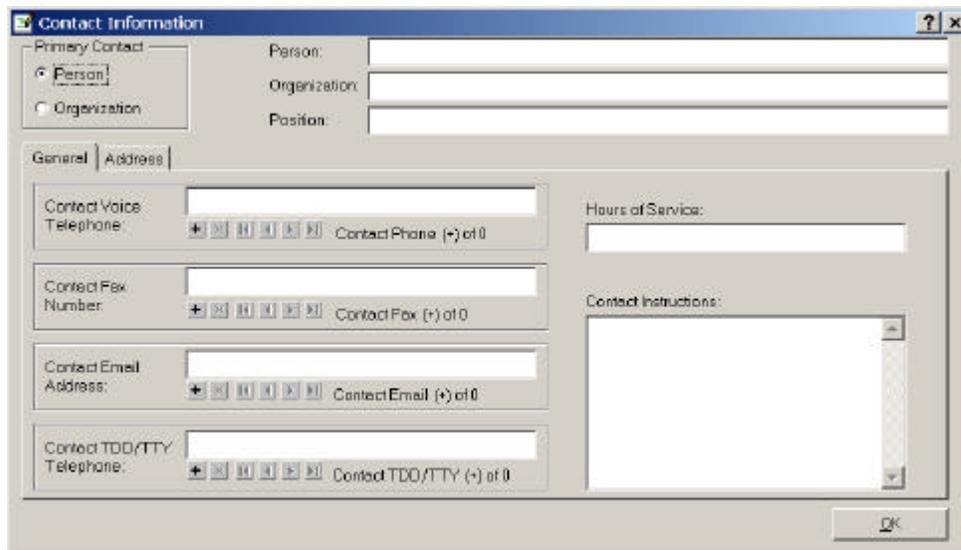
11. Now we are going to enter some general information that will always remain the same and be included in any metadata you generate for your ArcPad files. Click on the **Edit Metadata**  button to open the *Metadata Editor*.

- After a few seconds, the *Metadata Editor* dialog appears. Notice the seven main sections appear in across the top with the **Identification** section appearing in bold text. This is the currently selected section and this sections contents appear below. Notice there are 10 tabs of information for this section. Click on the *Contact* tab.



- Now click on the *Details* button. The following dialog opens. Use this form to enter your contact information. Type your name in the *Person* section. Enter your *Organization* and *Position* information.

NOTE: You can choose to make your organization the primary contact.



14. Enter your work hours in the *Hours of Service* section.
15. Enter any additional *Contact Instructions*.
16. In *Contact Voice*, enter your phone number.

NOTE: If you have more than one phone number, simply click the add **+** button to add another number. This add function works the same for all other fields that may have multiple entries.

17. In *Contact Fax*, enter your fax number.
18. In *Contact Email*, enter your email address.
19. If applicable, populate the *Contact TDD/TTY* information.
20. Click the *Address* tab.
21. Select the appropriate *Address Type*.
22. Enter the additional address information (City, State, Postal Code, Country).
23. Click **OK** when finished.

Contact Information

Primary Contact
 Person
 Organization

Person: Todd W. Sutherland
Organization: National Conservation Training Center - USFWS
Position: New Technologies Course Leader

General | Address

Contact Voice Telephone: 304-876-7453
+ x [Navigation] Contact Phone 1 of 1

Contact Fax Number: 304-876-7234
+ x [Navigation] Contact Fax 1 of 1

Contact Email Address: todd_sutherland@fws.gov
+ x [Navigation] Contact Email 1 of 1

Contact TDD/TTY Telephone: [Empty]
+ x [Navigation] Contact TDD/TTY (+) of 0

Hours of Service: 7:30 to 4:00

Contact Instructions: [Empty Text Area]

OK

24. The contact information you just entered needs to appear in 3 other locations throughout the metadata form. Unfortunately you will need to add this information to these other 3 locations. However, once this is accomplished and you save this file and export it out as a template, you will never have to enter this information again! Navigate to the following Sections/Tabs and enter your contact information again:

Data Quality / Process Step
Distribution / Distributor
Metadata Reference / General

NOTE: You do not have to populate all contact information locations during class. Try to populate at least 2 sections so you become familiar with the *Metadata Editor* interface.

25. Here is a list of other fields that are likely candidates for inclusion in your metadata template file. Enter these if applicable and as time permits for this exercise.

Identification / General / Access Constraints

Identification / General / Use Constraints

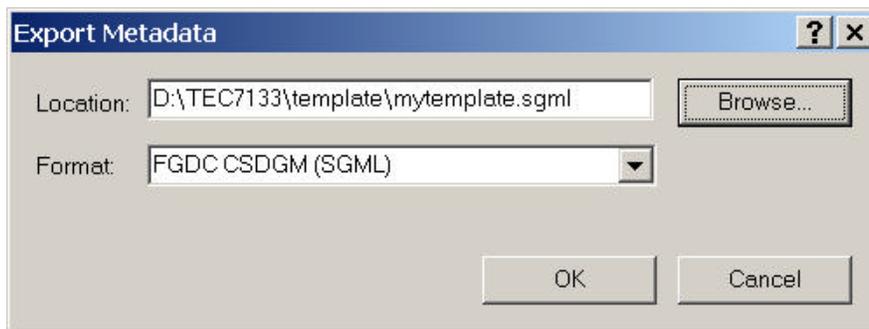
Identification / Citation / Details / Originator

Distribution / General / Distribution Liability

Example liability statement:

This data set was constructed for use by NCTC staff only. The U.S. Fish and Wildlife Service (USFWS) shall not be held liable for improper or incorrect use of the data described and/or contained herein. These data are not legal documents and are not intended to be used as such. It is the responsibility of the user to use the data appropriately and consistently recognizing its limitations. The USFWS gives no warranty, expressed or implied, as to the accuracy, reliability, or completeness of these data. It is strongly recommended that these data be acquired directly from the USFWS and not through other sources which may have changed the data. This disclaimer applies both to individual use of the data and aggregate use with other data.

26. Click **Save** when finished entering the form with template information.
27. Change the *Stylesheet* to **FGDC Classic**.
28. Scroll through the appropriate sections and examine your contact information. If you desire edits, simply go back into the *Metadata Editor* and make the necessary changes.
29. Once you get the information as you like, click the **Export Metadata**  button.
30. Change the *Format* to **FGDC CSDGM (SGML)**.
31. Click the **Browse** button and navigate to the `\TEC7133\template` folder. Assign the name `mytemplate.sgml` and click **Save**.
32. Click **OK** in the *Export Metadata* dialog.

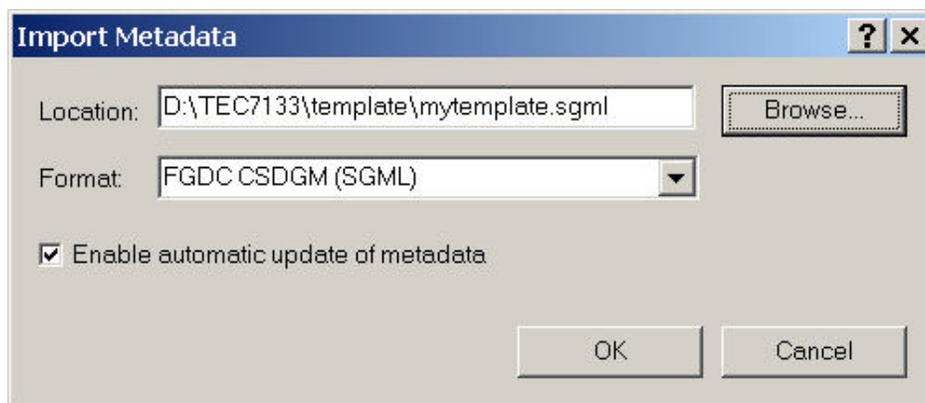


33. Congratulations! You have just created a metadata template.

PLEASE STOP HERE!

Importing your metadata template

1. In the Catalog Tree, select the *trails.shp* file.
2. Click on the *Metadata* tab.
3. Click the **Import Metadata**  button.
4. Click the **Browse** button and navigate to the template file you created in the previous section. Ensure “*Enable automatic update of metadata*” is checked. Click **OK**.



5. Use the **FGDC Classic** stylesheet and ensure your metadata template was successfully imported by looking for completed contact information sections.
6. Import your metadata template for the *parking.shp* layer.

METADATA EXERCISE

Use the *Metadata Editor* and populate the *Process Step* section for at least one of the following shapefiles:

structures.shp

trails.shp

parking.shp

This *Process Step* can be found in the **Data Quality** section.

The **Process Description** section should describe the methodologies you used in the field to collect the data. Be prepared to share with the class your process description. This metadata section can be as lengthy or as concise as you want. Some things to consider including in the process description are:

Were there any quality/capture rules established?

Were the rules ever broken?

Was averaging used? If so, how many seconds.

Was streaming vertices mode used for lines and polygons (if so, what interval was used)?

Was averaging used on vertices?

How was differential correction performed? Which base station was used?

What software packages and versions used?

What commands or functions were executed in the processing of this file?

Include anything you feel is relevant regarding the process you used to create this spatial layer file!

Feel free to complete other metadata sections as time permits.

TIP: If unsure what to put into a metadata field, simply click the **Help ?** button located in the upper right of the *Metadata Editor* dialog and then click on the field. A popup appears describing what information should be contained in the field.

Section 9

Creating Custom Forms with ArcPad Studio

Section 9 Objectives:

At the end of this section, you will be able to:

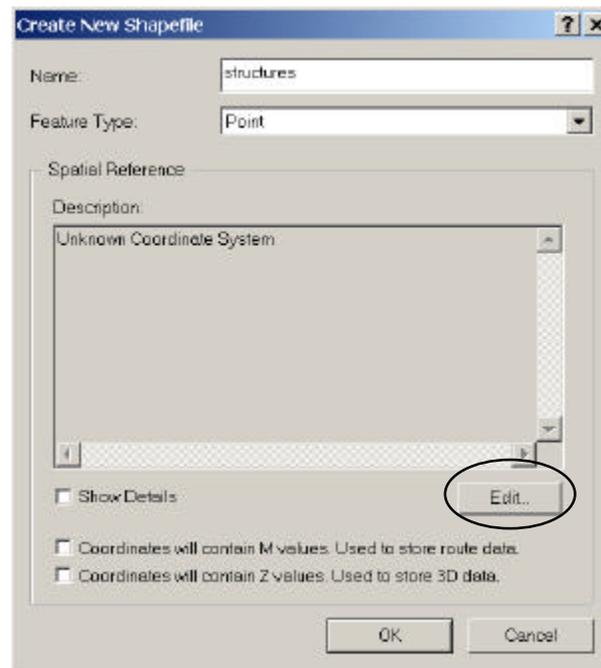
- Create a new shapefile using ArcCatalog
- Create a layer definition file using ArcPad Studio
- Assign Vbscript code to an “event”
- Build a custom form for you new shapefile

Creating Custom Forms with ArcPad Studio

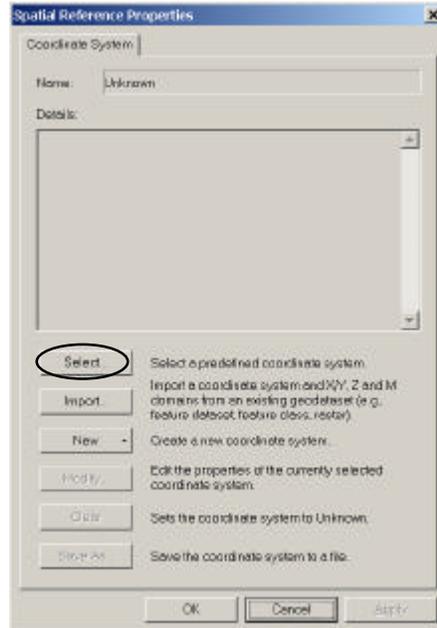
In this exercise you will build a customized form for a new shapefile. The form will allow you to streamline data collection in ArcPad. Forms are generated in ArcPad Studio by creating a layer definition file for your shapefile. You use existing shapefiles to build forms, however, in this exercise we will create a new shapefile from scratch using ArcCatalog.

Step 1 – Create new shapefile using ArcCatalog

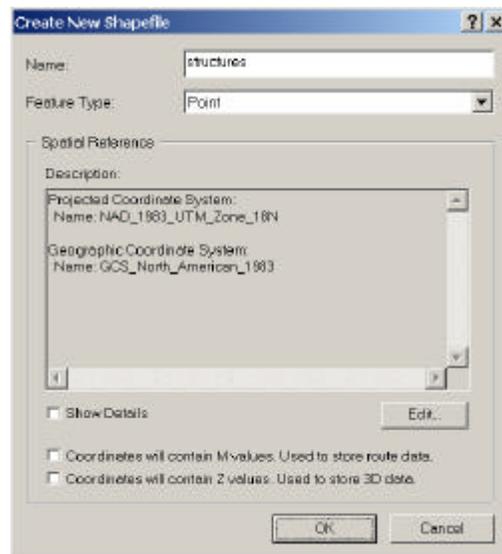
1. Open ArcCatalog.
2. Navigate to the *D:\tec7133\forms_exercise* folder.
3. Right click on the *forms_exercise* folder and select **New** and choose **Shapefile**.
4. Assign the name *structures* to the shapefile and then click on the **Edit** coordinate system button.



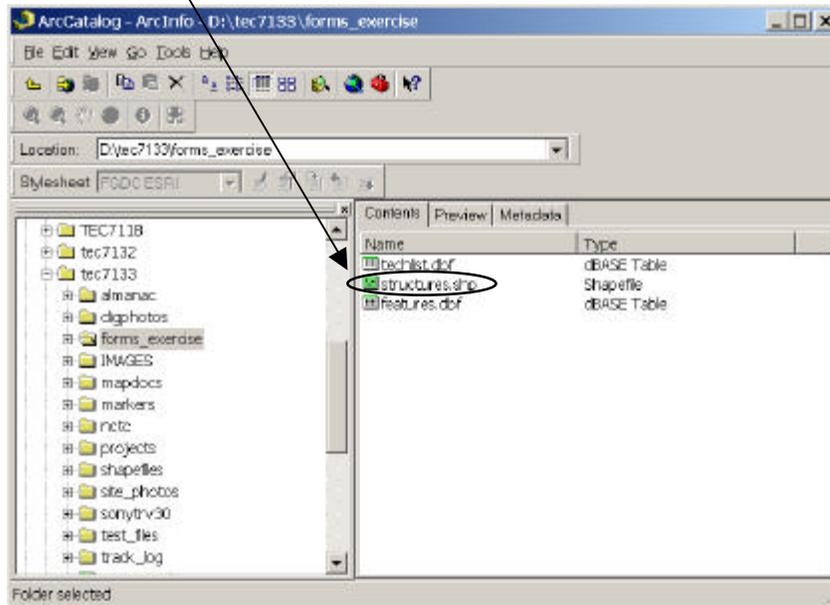
5. From the *Spatial Reference Properties* dialog, click the **Select** button.



6. Double click on the **Projected Coordinate Systems**. Continue navigating through the folders by double clicking on **UTM** and **NAD 1983**. Select the **NAD 1983 UTM Zone 18N.prj** file and click **Add**. This assigns a projection file to the new shapefile you are creating. Click **OK** when finished.
7. Your screen should match the example below. Click **OK** to close the *Create New Shapefile* dialog.



8. Your new shapefile now appears in ArcCatalog. Right mouse click on the *structures.shp* file and select **Properties**.



9. At the top of the *Shapefile Properties* dialog, click on the **Fields** tab. Your screen should match the example below.



10. Click in the empty row underneath ID to assign a new field name. Type in the following field name: gpstech
11. Hit **ENTER** or click in the same row under the Data Type column. Click on the down arrow and select **Date** from the list of data types.
12. Using the same procedures as above, add 3 more fields using the following parameters:

Field Name	Data Type	Precision*
gpstech	text	50
feature	text	50
condition	short integer	2

*Precision values can be edited in the *Field Properties* section.

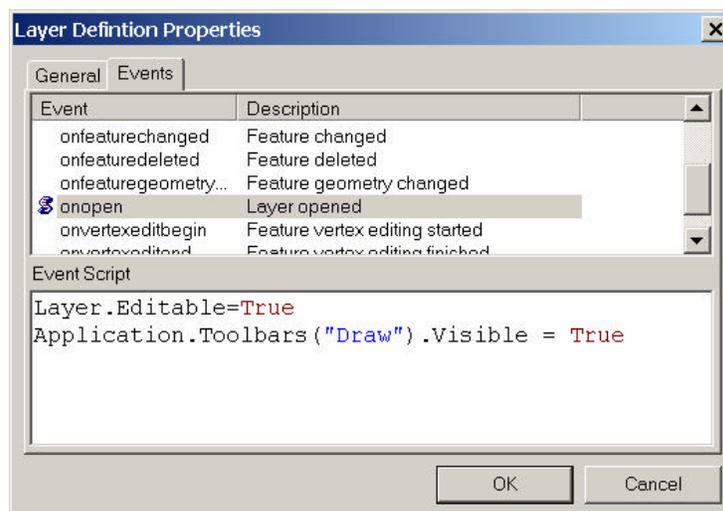
13. Your screen should match the example below. Click **OK** when finished.



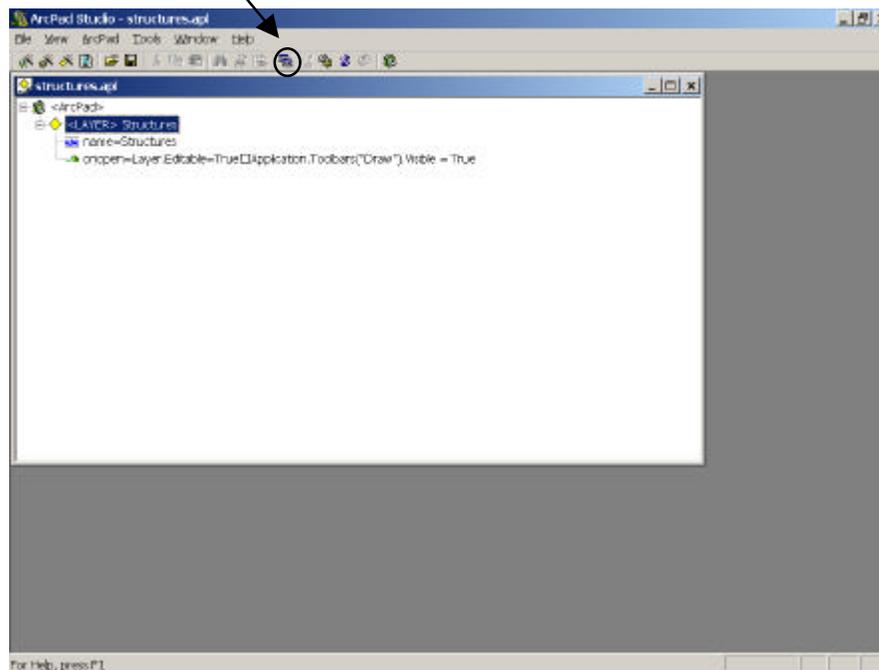
Step 2 – Create Layer Definition File using ArcPad Studio

1. Double click on the ArcPad Studio icon to launch the program.
2. From the **File** menu, select **New** and choose **Layer Definition**.
3. Navigate to *d:\tec7133\forms_exercise* folder and select the *structures.shp* file and click **Open**. This is the shapefile you just created in ArcCatalog.
4. Double click on **<LAYER>**.
5. Assign the name **Structures** for this layer. The name you enter will be the name that appears in the ArcPad Layer Properties dialog.
6. Click on the **Events** tab.
7. We want to write some Vbscript code that automatically puts this layer in edit mode and shows the Draw toolbar whenever we add this layer to ArcPad. This will save us a few steps when collecting data in the field. Scroll down and then double click on the **onopen** event.
8. Enter the following code:

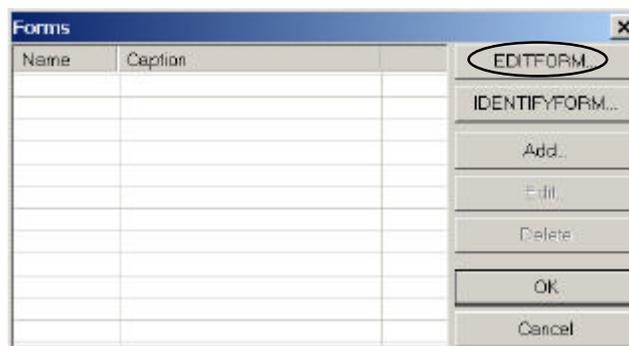
`Layer.Editable=True`
`Application.Toolbars("Draw").Visible = True`
9. Your screen should match the example below. Click **OK**.



10. Click on the **Forms**  button.



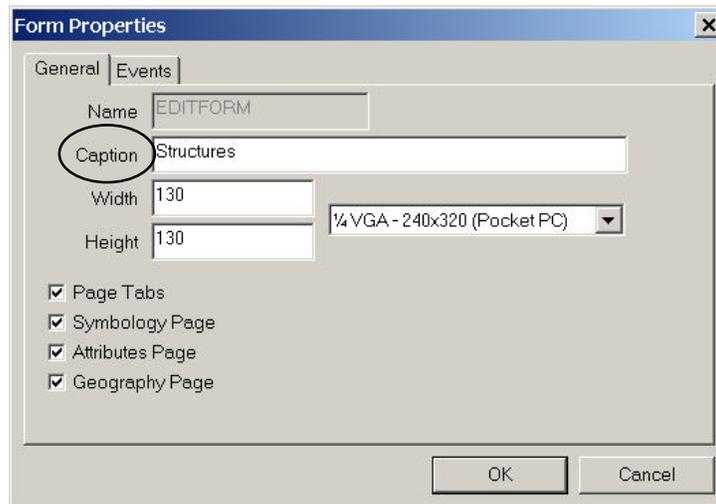
11. From the **Forms** dialog, click *EDITFORM*.



12. From the *Edit Form* dialog, click the **Form** menu and select **Form Properties**.

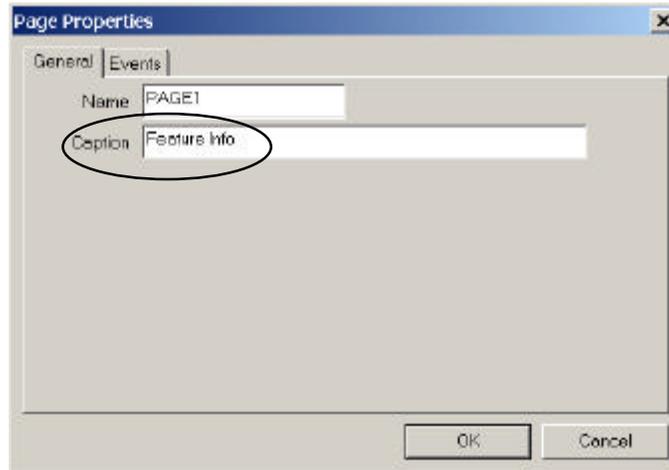


13. In the *Caption* section, type **Structures**. Click **OK** when finished.



14. Notice the name of the form dialog is now called *Structures*.
15. From the *Structures* form, click on the **Page** menu and select **Page Properties**. The *Page Properties* dialog appears.

16. In the *Caption* section, type *Feature Info*. Click **OK** when finished.



17. Notice the change on the *Structures* form. You are now ready to add some controls to the form and assign them to fields in our shapefile. The first field in our shapefile that we will add a control for is gpsdate.

PLEASE STOP HERE!

18. Click and hold on the **DATETIME**  control and drag it to the top center section of the *Structures* form and release.

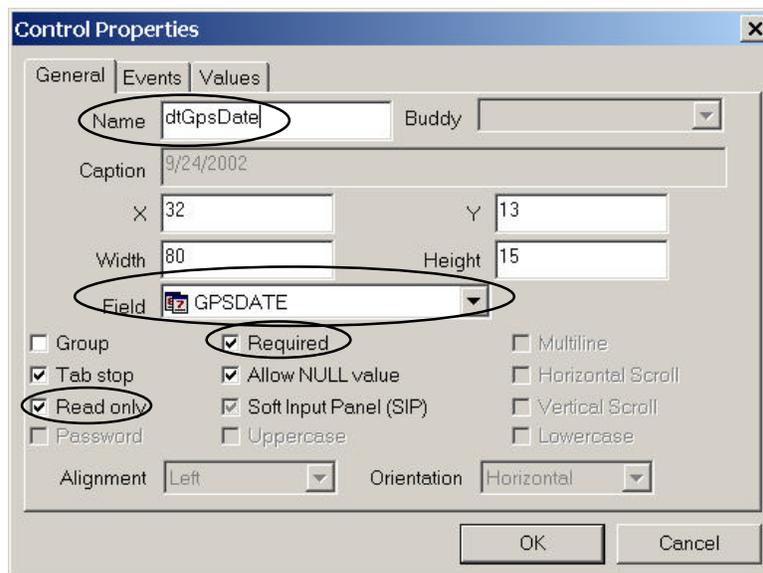


- The *Control Properties* dialog appears. Type **dtGpsDate** in the *Name* section.

NOTE: You could name this control anything you want. However, if you begin using Vbscript, then you would access the control in the script using the name assigned here. Therefore, following some standardization in naming controls and variables is wise. A common naming convention used by programmer's is Hungarian notation.

- Click on the drop down arrow to the right of *Field* and select the GPSPDATE field.
- Put check marks in the **Required** and **Read Only** sections. Your form should be similar to the example below (the X and Y may not match, depending on where you positioned the form).

NOTE: By checking the "required" attribute for the control, the user is required to enter a value for this field on the form. By checking the "read only" attribute for the control, the control is disabled on the form.



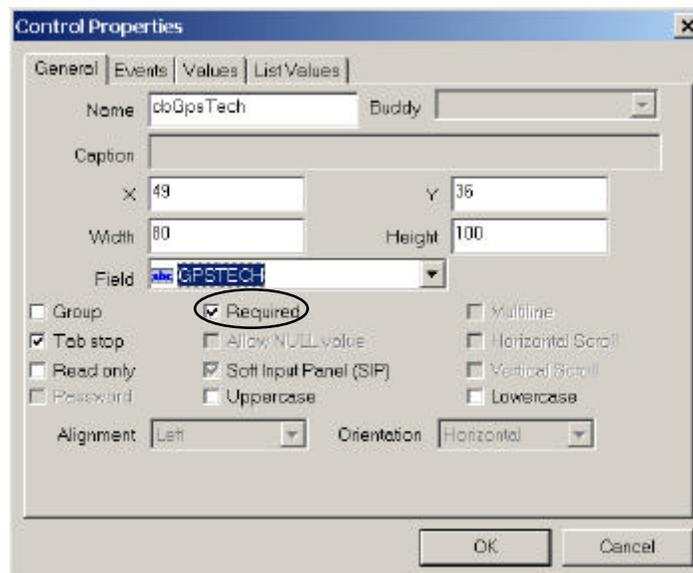
- Now, click on the **Values** tab. In the *Default Value* section, type the word **Date**. Click **OK** when finished.

NOTE: By putting the date function in the default value section, the current date is automatically populated into the form when a new point feature is created.

PLEASE STOP HERE!

23. Position the control near the right edge of the form by moving it (click, hold & drag).
24. For the next field, gpstech, we will add a COMBOBOX to our form. A Combo Box allows the user to choose from a list of values. A lookup table (*techlist.dbf*) has already been created for you and will be used to populate the combo box. Click and hold on the **COMBOBOX**  control and drag it underneath the dtGpsDate control and release.

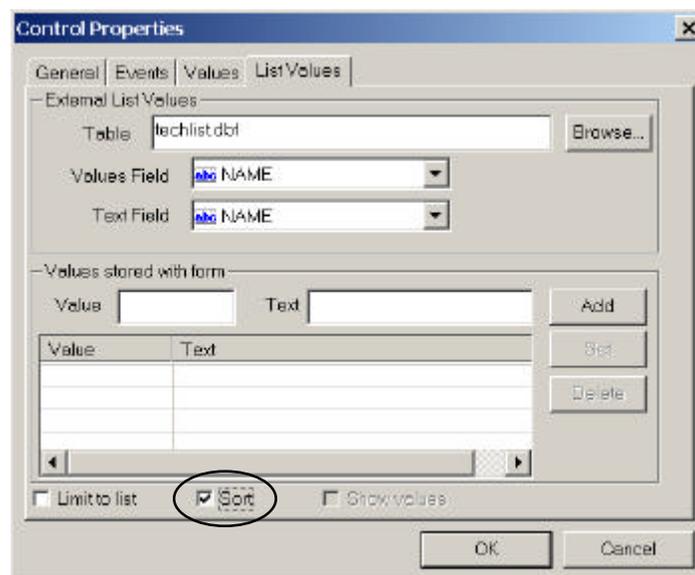
TIP: If you hold your mouse over a control icon, the name of the control appears.
25. The *Control Properties* dialog appears. Type **cbGpsTech** in the *Name* section.
26. Click on the drop down arrow to the right of *Field* and select the GPSTECH field.
27. Put a check mark in the **Required** section. Your form should be similar to the example below (the X and Y may not match, depending on where you positioned the form).



28. Now let's assign a lookup table which will be used to populate the drop down list in this combo box. Click on the **List Values** tab. Click the **Browse** button and select the *techlist.dbf* file. This is located in the *d:\tec7133\forms_exercise* folder. It should default to this folder. Click **Open** once it is selected.

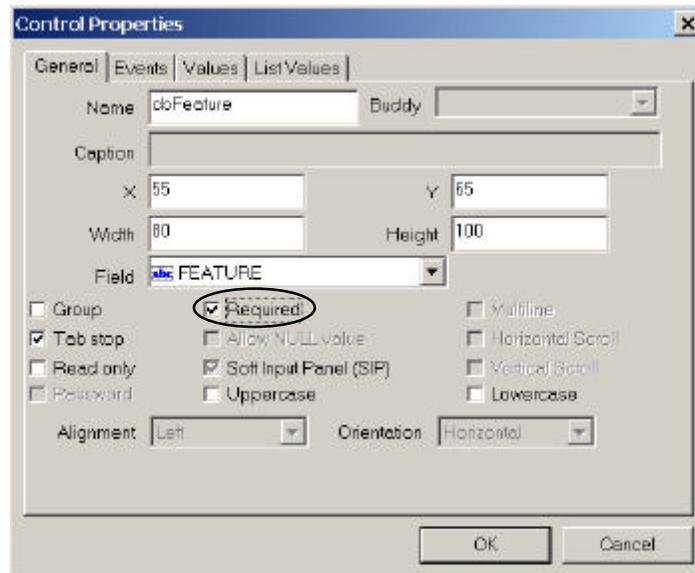
29. In the **Values Field** section, select **Name**.
30. In the **Text Field** section, select **Name**.
31. At the bottom of the *Control Properties* dialog, put a check next to the **Sort** attribute. Your form should match the example below. Click **OK** when finished.

NOTE: By checking the “sort” attribute for the control, the list of items that appear in the drop down box on the form are automatically sorted alphabetically.



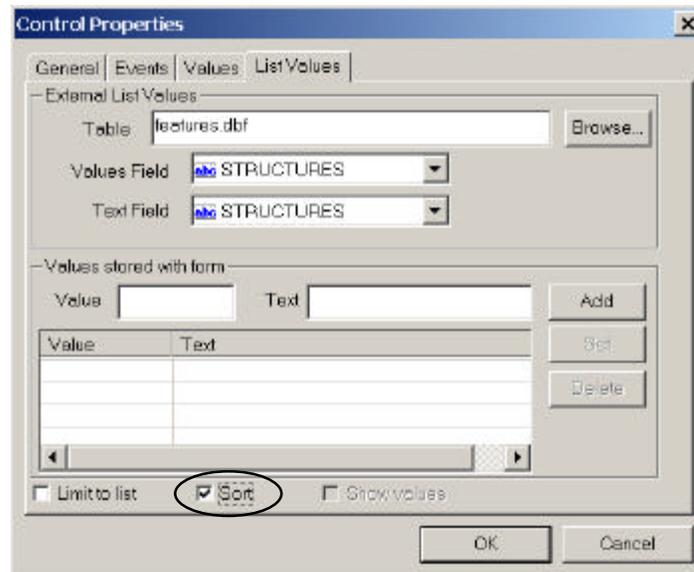
32. Position the control near the right edge of the form by moving it (click, hold & drag).
33. Now we need to assign a Combo Box for the feature field. Click and hold on the **COMBOBOX**  control and drag it underneath the cbGpsTech control and release.
34. The *Control Properties* dialog appears. Type **cbFeatures** in the *Name* section.
35. Click on the drop down arrow to the right of *Field* and select the FEATURE field.

36. Put a check mark in the **Required** section. Your form should be similar to the example below (the X and Y may not match, depending on where you positioned the form).



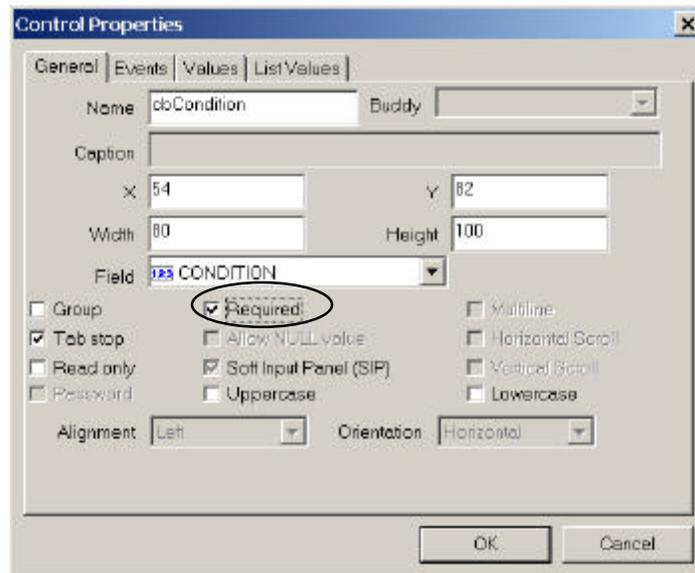
37. Now let's assign a lookup table for this combo box. This table has already been created for you as well and contains a list of structural features on NCTC. Now click on the **List Values** tab. Click the **Browse** button and select the *features.dbf* file. This is located in the *d:\tec7133\forms_exercise* folder. It should default to this folder. Click **Open** once it is selected.
38. In the **Values Field** section, select **Structures**.
39. In the **Text Field** section, select **Structures**.

40. At the bottom of the *Control Properties* dialog, put a check next to the **Sort** attribute. Your form should match the example below. Click **OK** when finished.



41. Position the control near the right edge of the form by moving it (click, hold & drag).
42. Now we need to assign a Combo Box for the condition field. Click and hold on the **COMBOBOX**  control and drag it underneath the cbFeatures control and release.
43. The *Control Properties* dialog appears. Type **cbCondition** in the *Name* section.
44. Click on the drop down arrow to the right of *Field* and select the **CONDITION** field.

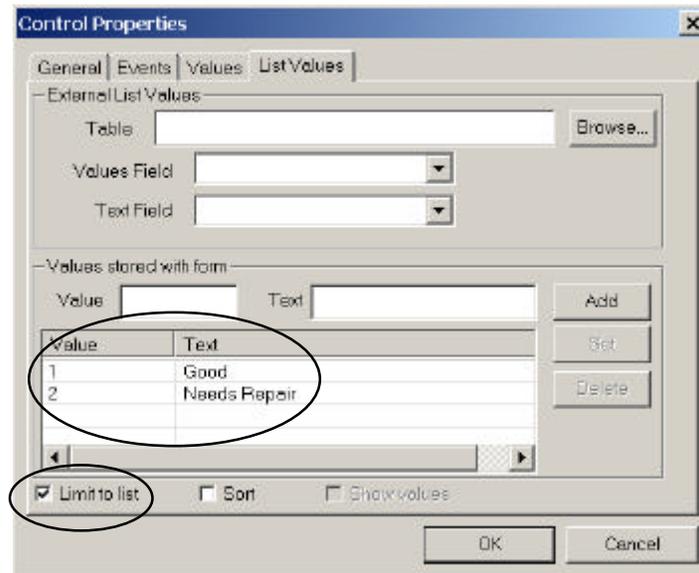
45. Put a check mark in the **Required** section. Your form should be similar to the example below (the X and Y may not match, depending on where you positioned the form).



46. Now click on the **List Values** tab. For this combo box, instead of using a lookup table, we will assign and store the values in the form (layer definition file) we are creating.
47. In the *Values stored with form* section, for Value type **1** and for Text type **Good**. Click **Add** when finished.
48. In the *Values stored with form* section, for Value type **2** and for Text type **Needs Repair**. Click **Add** when finished.
49. Check **Limit to list** at the bottom of the *Control Properties* dialog.

NOTE: By checking the “limit to list” attribute for this control, the combo box can display the text values you specified above.

50. Your screen should match the example below. Click **OK** when finished.

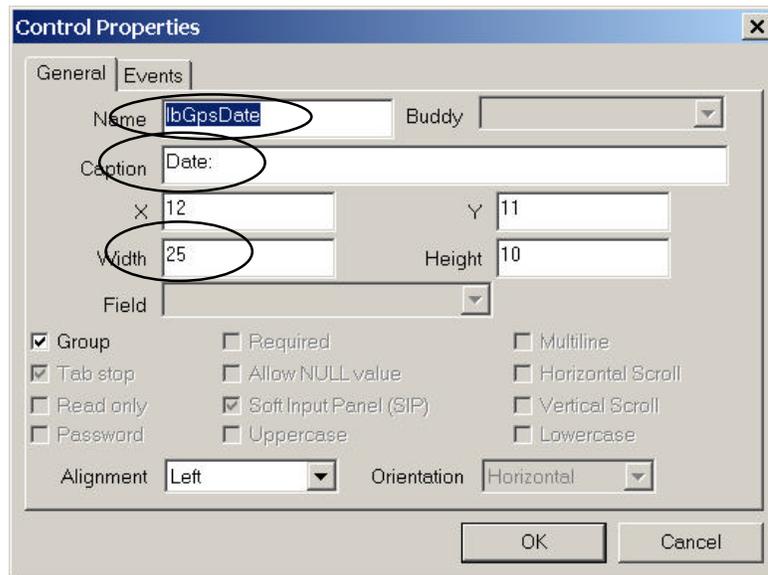


51. Position the control near the right edge of the form by moving it (click, hold & drag). Your form should be similar to the example given below.



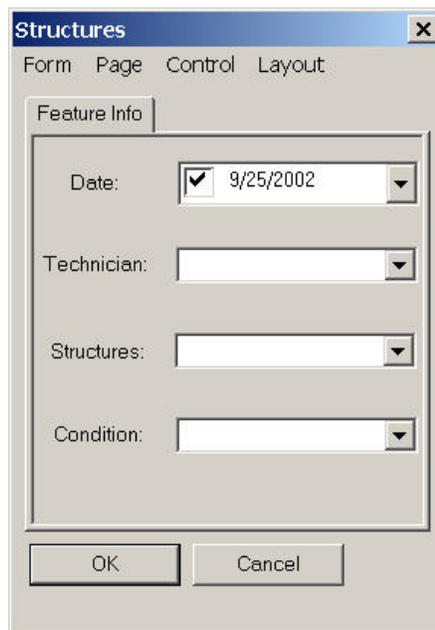
PLEASE STOP HERE!

52. Now we need to add labels for the controls so the user knows what these controls represent.
53. Click and hold on the **LABEL**  control and drag it to the left of the dtGpsDate control and release.
54. The *Control Properties* dialog appears. Type **lbGpsDate** in the *Name* section. In the *Caption* section type **Date:**. Also, change the width of the control to **25**. Click **OK** when finished.



55. Position the label control on the left side of the dtGpsDate control.
56. Click and hold on the **LABEL**  control and drag it to the left of the cbGpsTech control and release.
57. The *Control Properties* dialog appears. Type **lbGpsTech** in the *Name* section. In the *Caption* section type **Technician:**. Also, change the width of the control to **40**. Click **OK** when finished.
58. Position the label control on the left side of the cbGpsTech control.
59. Click and hold on the **LABEL**  control and drag it to the left of the cbFeatures control and release.
60. The *Control Properties* dialog appears. Type **lbFeatures** in the *Name* section. In the *Caption* section type **Structure:**. Also, change the width of the control to **40**. Click **OK** when finished.

61. Position the label control on the left side of the cbFeatures control.
62. Click and hold on the **LABEL**  control and drag it to the left of the cbCondition control and release.
63. The *Control Properties* dialog appears. Type **lbCondition** in the *Name* section. In the *Caption* section type **Condition:**. Also, change the width of the control to **40**. Click **OK** when finished.
64. Position the label control on the left side of the cbCondition control. Your form should be similar to the example given below.

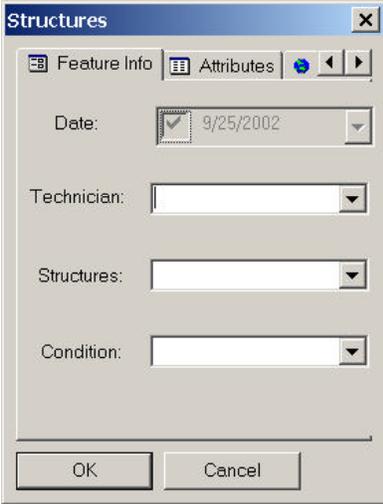


The image shows a screenshot of a software dialog box titled "Structures". At the top, there are tabs for "Form", "Page", "Control", and "Layout", with "Form" selected. Below the tabs is a sub-tab labeled "Feature Info". The main area of the dialog contains four fields, each with a label on the left and a control on the right: "Date:" with a date picker showing "9/25/2002" and a checkmark; "Technician:" with an empty text box; "Structures:" with an empty text box; and "Condition:" with an empty text box. At the bottom of the dialog are two buttons: "OK" and "Cancel".

65. Click **OK** when finished building the form.
66. From the **File** menu, click **Save**.
67. From the **File** menu, click **Exit**. You are finished creating the form!

Step 3 – Testing Your Form

1. Launch ArcPad on your PC.
2. Click **Add Layer**. Navigate to the *d:\tec7133\forms_exercise* folder and select the *structures.shp* layer file. Click **OK**
3. Notice the *Structures* layer has been automatically put into edit mode and the *Draw* toolbar appears.
4. Add a feature anywhere on the display using the **Point**  tool. The *Structures* form automatically appears.



The screenshot shows a dialog box titled "Structures" with a close button (X) in the top right corner. Below the title bar are two tabs: "Feature Info" and "Attributes". The "Attributes" tab is selected. The dialog contains four fields, each with a label and a control:

- Date:** A date picker showing "9/25/2002" with a checked checkbox to its left.
- Technician:** A dropdown menu.
- Structures:** A dropdown menu.
- Condition:** A dropdown menu.

At the bottom of the dialog are two buttons: "OK" and "Cancel".

5. Use the form to attribute the feature you just added using the combo box controls.
6. Ensure the DATE control displays the current date and is automatically checked and disabled on the form.
7. Ensure the TECHNICIAN and STRUCTURES combo boxes displays a list of values sorted alphabetically. Select any one value in each.
8. Ensure the CONDITION combo box has 2 text values. Select any value.

9. Now, click the **Attributes** tab and check the attributes populated into the database. Ensure a numeric value appears in the CONDITION field and all other fields are populated (except ID).



10. If necessary, go back into ArcPad Studio and edit the form.

Challenge Topic

Use ArcPad Studio and edit the *structures.apl* file.

Make the following changes:

- 1) Edit the layer definition file so the TECHNICIAN combo box automatically defaults to “your last name” and the combo box is disabled on the form.
- 2) Edit the layer definition file so the CONDITION combo box automatically defaults to “Good”.
- 3) Ensure that the user CANNOT enter a feature that is NOT in the current list of features.

Test your new form in ArcPad to ensure these changes are in effect.

Section 10

Customizing the ArcPad Interface

Section 10 Objectives:

At the end of this section, you will be able to:

- Setup an ArcPad skin file on your desktop PC
- Create an ArcPad configuration file using ArcPad Studio
- Create a custom toolbar

Customizing the ArcPad Interface

In this section you will learn how to customize the ArcPad interface. This can easily be done without any programming experience. However, if you wish to develop your own customized tools, you need to be familiar with the VBscript programming language.

First, you are going to learn how to configure an ArcPad skin file. A skin file is essentially a bitmap with a window for the ArcPad application to run within. By using a skin, you can demonstrate ArcPad on your PC while presenting to others an indication of what ArcPad actually looks like when running on an iPAQ or other handheld device.

Secondly, you will use ArcPad Studio to create a default configuration file. You will create a new tool bar that contains only necessary tools for your application. By minimizing the number of tools, you can streamline the process of collecting GPS data for users and minimize the amount of training required.

Procedures to setup and run a skin from the ArcPad desktop icon

1. Open Windows Explorer and navigate to the *d:\tec7133\arcpad_skins* folder.
2. Copy the 2 files (*3650.skn*, *3650.bmp*) that reside in this folder and put them in the same folder as your ArcPad program file (*c:\Program Files\ArcPad\WinNT*) folder. Minimize or close Windows Explorer.

NOTE: The skin files were obtained from ESRI's web and are included on your course CD.

3. From the Windows desktop, right click on the ArcPad icon.
4. Click **Create Shortcut**.
5. Right click on the new shortcut icon just created on you desktop and select **Properties**.
6. Click on the *Shortcut* tab.
7. In the **Target** section, enter the following text (no spaces) after the path to the ArcPad executable:

```
/skin="c:\Program Files\ArcPad\WinNT\3650.skn"
```

NOTE: Ensure there is one space after the path to the executable and the line above.

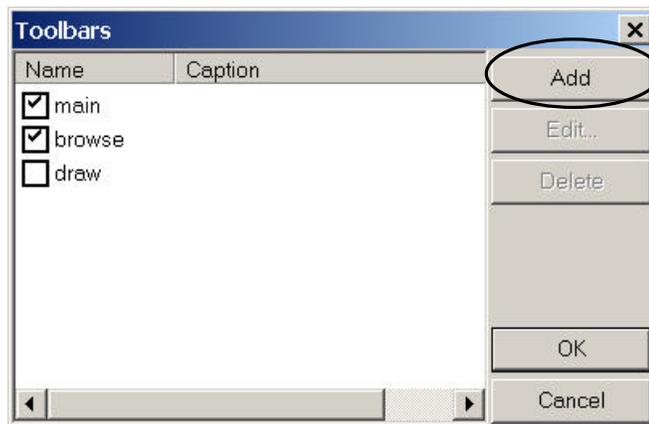
8. Click **OK** when finished.
9. Double click on the ArcPad icon to ensure your setup is complete. ArcPad should now run within the window of the iPAQ 3650 skin.
10. Close ArcPad.
11. Rename the short cut icon accordingly.

Extra: Setup another shortcut to ArcPad using a skin for the GeoXT. Use the *GeoXT.bmp* and *GeoXT.skn* files.

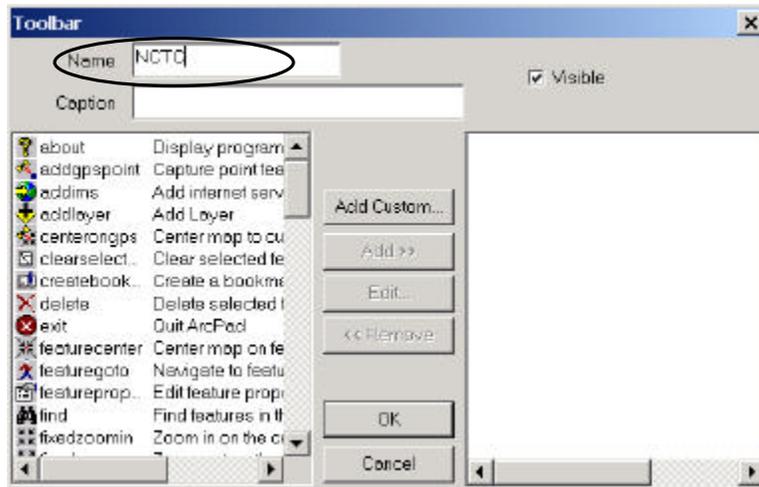
Creating a default configuration file

It is very easy to customize the appearance of ArcPad. In this exercise you will create a new toolbar. Next, you will put some commonly used tools on the new toolbar. Finally, you will set the visibility for all toolbars and the status bar.

1. Open ArcPad Studio.
2. From the **File** menu, click **New** and choose **Configuration**.
3. From the **File** menu, click **Save**. Navigate to the *d:\tec7133\export* folder.
4. Name the file *arcpad.apx* and then click **Save**.
5. Click on the **Toolbars**  icon.
6. Click **Add**.



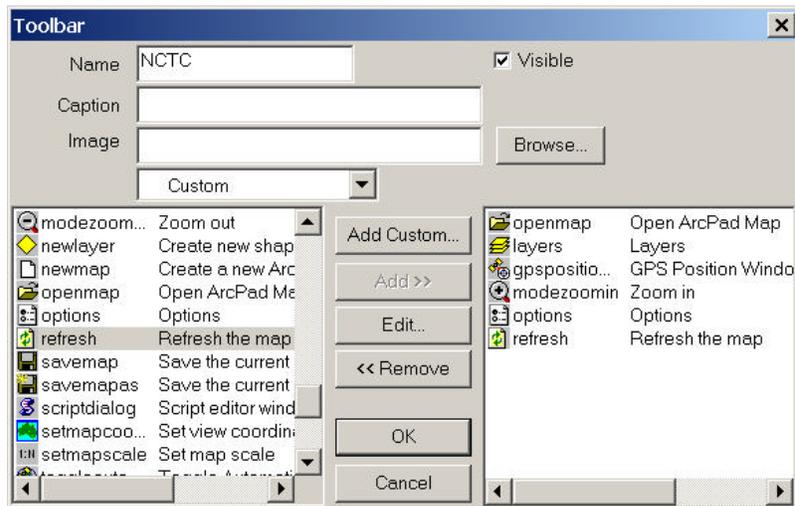
- Type **NCTC** in the *Name* section.



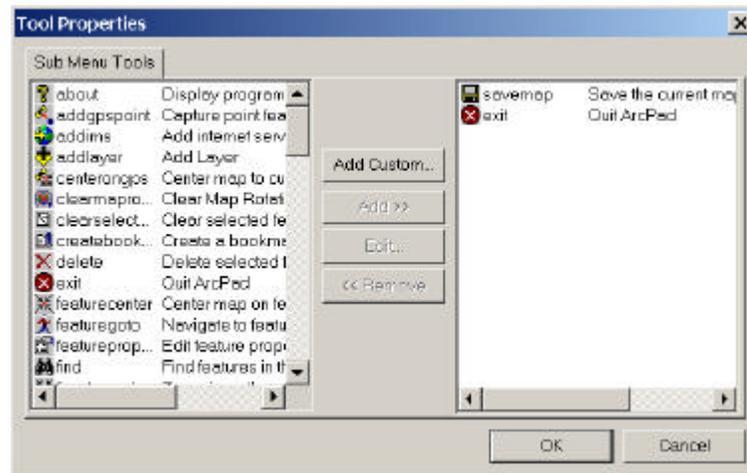
- Now, from the *Toolbar* dialog, double click on the tools below **in the following order** (you will have to scroll to locate them):

Open ArcPad Map
 Layers
 GPS Position Window
 Zoom In
 Options
 Refresh the map

- Your screen should match the example below.

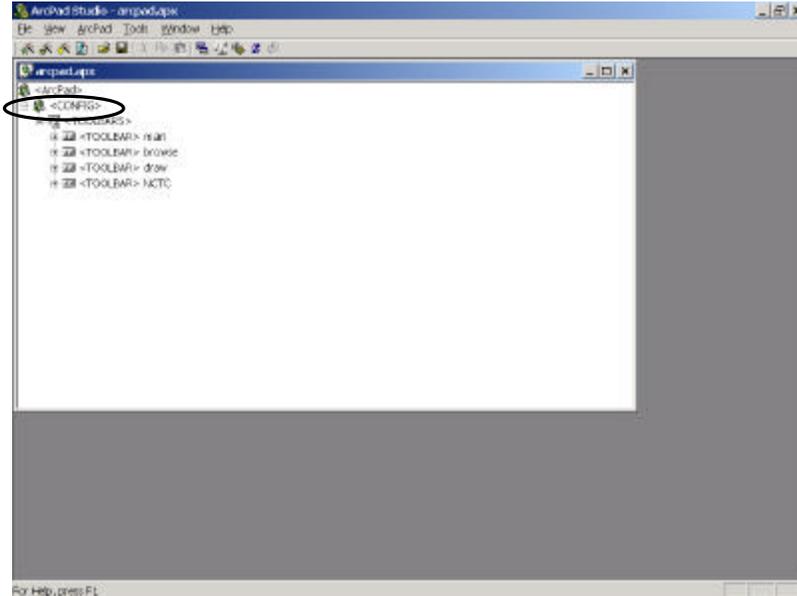


10. Now double click on the *Open ArcPad Map* tool you just added to your new toolbar. A new *Tool Properties* dialog appears.
11. You now will assign sub menus. Double click on *Save the current map* to add this tool as a sub menu choice. Next add the *Exit* tool. Your dialog should match the example below. Click **OK** when finished adding these 2 tools.

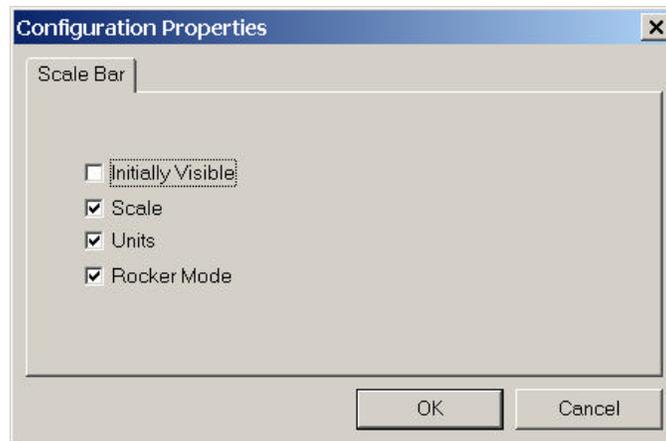


12. Next, add the *Add Layer* and *New Layer* tools as sub menus for the *Layers* tool.
13. Add the *GPS Enable* tool as a sub menu for the *GPS Position* tool.
14. Add the *Zoom To Previous*, *Zoom to Full Extent* and *Zoom to Layer* tools as sub menus for the *Zoom In* tool
15. After you finish, click **OK** and close the *Toolbar* dialog.
16. In our custom configuration, we only want the *Draw* and *NCTC* toolbar to show. Click on the **Toolbars**  icon.
17. Uncheck the *Main* and *Browse* toolbars and ensure a check is placed next to the *Draw* and *NCTC* toolbar. Click **OK**.

18. Double click on **<Config>**.



19. In our custom configuration, we do not want the *Status Bar* to be displayed. Uncheck "Initially Visible". Your screen should match the example below. Click **OK** when finished.



20. From the **File** menu, click **Save**.
21. From the **File** menu, click **Exit** to close out of ArcPad Studio.
22. To test on your PC. Copy your new ArcPad configuration file to the *c:\Program Files\ArcPad\System* folder.

23. Open ArcPad using a skin and ensure you new toolbar is displayed. Also, check to ensure the *Status Bar* is NOT displayed.
24. Connect your iPAQ to the cradle and setup as a *Guest*.
25. Copy the file to the *My Pocket PC\ArcPad\System* folder.
26. Test your new configuration on your handheld device.

NOTE: If you want to restore the original default ArcPad configuration settings, simply delete the *arpad.apx* file from the *System* folder.

CHALLENGE TOPIC: Ensure that all other toolbars associated with any applets do not appear when you open ArcPad. Also, move the *Draw* toolbar below the *NCTC* toolbar.

EXTRA CREDIT: Display a message box that displays “Welcome to Phoenix” when the ArcPad application is launched.

Hint: Associate the script below with the *onstartup* event for the **Application** object.

sample script

msgbox “Welcome to Phoenix”