

OBJECTIVE The objective of this lab is to collect data in the field using a mapping-grade GPS receiver. Students will collect point data over features where the horizontal position is known, and area data around significant landscape features. Students will check and modify the settings on the GPS receiver they are issued, and document them.

ASSIGNMENT Follow the instructions noted below to become accustomed to the Trimble GeoExplorer GPS data receiver.

DUE TODAY: Have the instructor or teaching assistant check your data form.

Using Warnell's Trimble GeoXM GPS units and ArcPad 10 in the field

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This document describes how to use Warnell's GeoXM GPS units to collect data in the field. The following instructions specifically refer to the GeoExplorer 2005 Series units (figure 1), not the older GeoExplorer 3 GPS units (3 buttons in the front panel).



Figure 1. The GeoXM

The GeoXM basics

The GPS antenna is located on the top of the unit, under the "Trimble" name. It is important to make sure this part of the unit is not covered or obstructed (with your books, clip board, paper, hat, etc). If it is, you will not get a good GPS signal - if any.

Press the green ON/OFF button in the lower right for 2 seconds to turn the unit on. It is always a good idea to start with a *software reset*. With the unit already on, press and hold the ON/Off button until the screen goes blank (no more than 60 seconds). The device will automatically reboot. If the unit becomes sluggish or non-responsive, do another software reset, but be careful, all unsaved work (unsaved text documents, shapefiles that are still in edit mode, etc) will be lost.

The 4 large icons on your screen (figure 2) will (from left to right)

1. Start ArcPad
2. Display the amount of charge left on the battery,
3. Show the amount of memory being consumed by running programs and a tap will show you a list of those programs,
4. Show the amount of storage you have available on the device and tap it to open the file explorer.



Figure 2. The GeoXM main screen

You can also open ArcPad 10, the power and memory utility, and the file explorer using the shortcuts contained under the Start menu.

The RIGHT/LEFT arrows icon shown in the menu bar allows you to turn *flight mode* on and off. Tap it once and the Connectivity dialog will appear. You want flight mode turned ON (this disables the WiFi radio).

Setting up your data collection project

You will be transferring data to and from the desktop and mobile device. To make things easier for yourself, you should create a new and uniquely named folder for each of your projects or labs. Make sure all of your data is stored in this folder. Also be wary of turning your unit in without transferring your entire folder to your desktop computer. Many students have access to these devices and they do have the ability to delete files!!!

Create a new project folder

1. Open the file explorer by tapping the right-most icon (figure 2)
2. Navigate to My Documents

- a. tap the Menu link in the lower right and select "My Documents"
3. Create a new folder
 - a. tap the Menu link and select "New Folder"
 - b. enter a unique folder name using the onscreen keyboard
 - c. use only characters *a-z* and *1-0*
 - d. refrain from using spaces in the name

Transferring files to and from your desktop computer

On the Windows 7 machines in the GIS lab,

1. Plug the GeoXM base into a USB port on the desktop
2. Turn the device on and place it into the base
3. Windows Mobile Device Center will automatically start
4. Click on "Connect without setting up your device"
5. Click on "File Management" and "Browse the contents of your device"
6. Drill down to "My Documents"
7. Drag files or folders to and from the device as needed

On the XP machines in other labs

1. Plug the GeoXM base into a USB port on the desktop
2. Turn the device on and place it into the base
3. ActiveSync will automatically start
4. ...
5. ...
6. Drill down to "My Documents"
7. Drag files or folders to and from the device as needed

Getting started with ArcPad 10

Tap the ArcPad icon (or goto Start > ArcPad) to start the program. As it is starting up, you'll receive a "Microsoft SQL Server Compact Edition initialization error...". This is not critical, tap OK, be patient, and ArcPad will load.

The first screen you are presented with allows you to either create a new map, create a special ArcPad project called a QuickProject, or to open an existing map. For now, our purpose is to collect the data and dump it to our desktop, so you need to tap "New map" on this screen to open an empty map. If you have an ArcPad project you've created earlier you'd like to revisit, then you can open it from here by selecting "Choose map to open".



**Figure 3. ArcPad 10
welcome screen**



Figure 4. ArcPad 10 toolsets

You should now see the ArcPad 10 interface. There are two rows of buttons you will interact with. I refer to the top row as the *primary toolset*. The two you will use the most are (from left to right) the first and third ones, the "main" and the "data" toolsets. The main toolset, shown as a closed folder icon, provides access to tools you will use to create new shapefiles and adjust the GPS receiver options. You will use the data toolset, shown as the pencil drawing a line, when you are actually collecting data.

Notice that when you tap an icon on the primary toolset, the tools on the *secondary toolset* change. Additionally, some of these secondary buttons contain multiple tools which can be accessed by tapping the dropdown arrow - the small black triangle. You also have access to pan and zoom in/out/extent tools (the hand, magnifying glasses, and the world). To use the zoom in/out tools, you tap the one you want and then draw a box around the area with your stylus you'd like to zoom. If you want to zoom again, you must re-tap the zoom tool and then draw another box. Tap the world tool to zoom to the full extent of your map. Tap the hand-shaped pan tool, and drag with your stylus across the screen to pan.

Collecting data

The process you will follow each time you collect data in lab will go like this:

1. create a new shapefile for each feature type (point, line, polygon) you want to capture
2. set your data capture defaults
3. collect the data
4. post processing on the desktop

These steps are detailed below.

Create a new shapefile

Our units are set up to store the GPS data as either a point, polyline, or polygon feature. Go ahead and create a new one each time you are in the field, the files can be combined later in the computer lab. Here's how to create a new shapefile in ArcPad 10:

CREATE SHAPEFILE

1. primary toolset > Open > New > Shapefile
2. in the next dialog at the top of the screen, select the feature type
 - a. either a point, polyline, or polygon
3. add at least 1 field to the shapefile

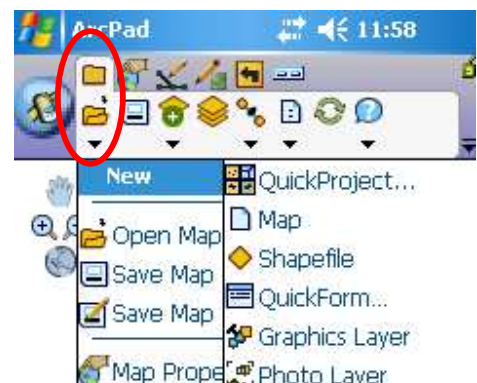


Figure 5. Create a new shapefile

- a. tap the "+" (plus sign) near the bottom of the screen
- b. specify a field name and type, then hit OK
- c. repeat these steps if you want to add more fields
4. tap the green OK button at the bottom left
5. point, polyline, polygon
6. Add at least 1 field to the shapefile
7. tap on the "+" (plus sign) near the bottom
 - i. give it a name, type, hit OK
8. repeat if you need to add another field
9. Hit the green OK at the bottom left

SAVE THE SHAPEFILE (in the dialog shown after you hit OK in step 9 above)

1. name your new shapefile
 - a. only use an underscore, a-z, and 1-0 - no wild characters
2. select the folder you created for this project
3. tap Save

CREATE A QUICK FORM

1. tap YES to create a QuickForm
2. check the Attributes Page and Geography Page boxes on the next screen
3. tap the green OK button at the bottom left
4. tap OK on the QuickForm dialog

At this point, you are ready to begin collecting your data. Remember to create ONE shapefile for each feature type (points, lines, or polygons) you plan to record that day. You should store your day's point data collection in one point shapefile, your day's line data collection in one line shapefile, and your day's polygon data collection in one polygon shapefile. You do NOT want to create, for example, one polygon shapefile for every area you traverse or one line shapefile for every road you capture.

Objects like telephone poles, places of interest, your truck, etc. should be marked as a point feature type. Things like roads, trails, and in my opinion, anything that is not a point, should be captured as a line feature type - the points and lines can be combined into a polygon in the office. I will expand on this later on in this document.

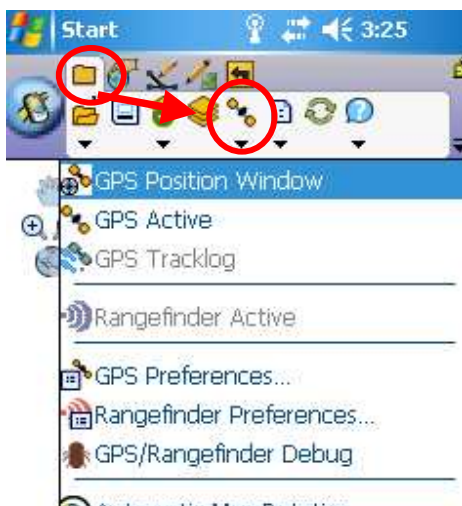


Figure 6. Set your data collection defaults

Set your data collection defaults

Before you begin the data collection process, you should set your data averaging preferences, activate the GPS receiver, and evaluate the GPS signal quality.

POINT AVERAGING

1. main toolset > GPS tool
2. tap GPS Preferences
3. tap the Capture tab at the bottom of the screen

4. enter at least 50 for points and vertices (top two boxes)
5. enter 1 for position interval and distance interval (bottom two boxes)

ANTENNA HEIGHT (still in GPS Preferences)

1. tap the GPS Height tab at the bottom of the screen
2. enter 1.4 for the Antenna Height (that is 4.5 feet)
3. tap the green OK button in the bottom left of the screen

ACTIVATE THE GPS RECEIVER

1. main toolset > GPS tool
2. tap GPS Active

Right now, you should see a red banner across the bottom of the screen that says "No Fix". At this point, please don't complain to your instructor about this warning. It is just informing you that your GPS receiver is not tracking enough satellites to acquire a fix (ie. your latitude/longitude). When your location is determined, this warning will go away.

EVALIATE GPS SIGNAL QIALITY

1. main toolset > GPS Position Window
2. Data tab: displays the current Lat/Long, altitude, speed, GPS mode, and PDOP
3. Skyplot tab: graphical display of satellite constellation
4. Compass tab: it's a compass
5. Quality tab: displays all DOPs and errors
6. tap the green OK button at the bottom left when you are finished

If you don't see any readings, wait a few minutes while the receiver locates the satellites. You might want to move to an open area if you are currently under canopy.

Collect data

At the very bottom right of your screen, you should see a scale bar. You are probably zoomed way out. Tap it to reveal a sliding bar that will zoom you in and out. Drag the bar all the way to the top. Tap the scale bar again to hide the incremental zoom tool. You should now be zoomed in enough to see what you are doing.

ACTIVATE LAYERS FOR EDITING

You can only store data in an active layer which are shown bounded by a red box in the layer list (data toolset > layer list). Open the layer list and make sure your layer has a red box around it. If it does not, tap it. Open the layer list again to verify your layer is active. The figure to the right shows the Points layer and the Lines layer active.

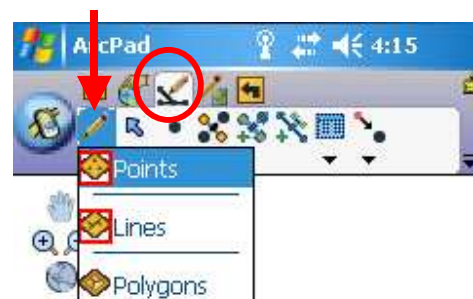


Figure 7. Activate layers

CAPTURE POINT DATA

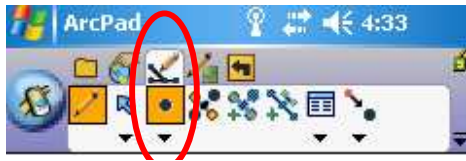


Figure 8. Select feature type to record

measure you set in the preferences), and

4. tap the collect point data tool (figure 9).

5. Enter attribute information in the dialog that appears.

6. Scroll over to the Geography tab to view the X, Y, and Z (elevation) measures and the number of readings the unit has currently collected for that point.

7. When the number of readings exceeds the number you set in the preferences for point averaging, hit the green OK button in the lower left.

1. Activate the point layer.
2. Select the point capture tool which can be found by clicking on the down arrow below the feature type button (in the data toolset) - it is the point icon (figure 8).
3. Walk to the feature you wish to capture, hold the unit over it (at 4.5 feet, the same



Figure 9. Tap the point capture tool to initiate point data collection

CAPTURE LINE (and POLYGON) DATA

Line and polygon data capture are identical. If you want to capture line data, you select the polyline tool (figure 8) and if you want to capture polygon data, select the polygon tool from the same dropdown list.



Figure 10. Capture an initial averaged vertex

for the first point of the line and wait until the appropriate number of readings has been stored.

5. Tap the capture streaming vertices button (figure 11) to turn on streaming mode and walk at a normal pace around the boundary
6. Where the boundary changes course, tap the streaming capture to turn it off, then tap the capture average vertex button, and
7. when finished, tap the streaming vertex button again.
8. When you are finished, tap the green arrow at the bottom of the screen, then
9. tap the Geography tab to see the length or area and the XY coordinates of each vertice.
10. Deactivate the layer (no red box around the layer name).

1. Activate the line (or polygon) data layer.
2. Select the polyline tool (not the line tool) which can be found by clicking on the down arrow below the feature type button (in the data toolset).
3. Walk to the starting of the feature you wish to capture.
4. Tap the average vertex button (figure 10)

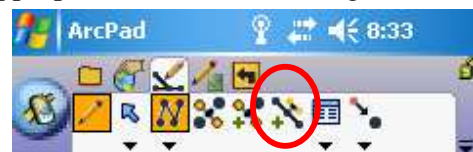


Figure 11. Capture streaming vertices while walking

Final thoughts

Keep in mind that your GPS data collection is only one part of the puzzle. I assume your task is to address some question posed about the property (how many cruise plots do we need to put in, how many acres of each type do we have, how large is the current harvest, how will our forest be affected if we put the road here, etc.). Keep this in mind when you are planning your project and schedule your time appropriately.

When you are on the ground collecting GPS data, try not to visit the same piece of ground more than once. Instead of marking all of your areas as polygons which requires you to walk the perimeter of each area, use points and lines. Capture a GPS point anywhere the boundary changes direction. Between these points, capture a GPS polyline. Your workflow should look something like the following:

1. Load the current imagery into ArcGIS and delineate everything you can from the photo.
2. Evaluate the remaining unmarked areas of the property and plan your GPS mission making note of:
 - a. the parts of the forest on which you must collect GPS data,
 - b. how you can delineate these boundaries without marking the same area twice (common boundaries should be marked once with points and lines, etc),
 - c. how you will collect each part (either as a point, polyline, or polygon),
 - d. the order in which you will collect the data,
 - e. how to get back to your vehicle after you have finished,
 - f. etc.
3. Make sure the GPS unit is fully charged the night before you visit the field and that you know how to use it.
4. Upload and reconcile all the data in the lab on the desktop in ArcGIS with the aid of the current aerial photography as a background.

Post processing instructions are contained in the companion Word document (GPS post processing at Warnell).