

Geog 315 / ENSP 428 – Spring 2010

Lab 2: GPS and Laser rangefinder surveying exercise

Objectives

In this lab you will learn how to geographically reference field samples. We will begin by discussing “mission planning” before you actually go out in the field. In the first part of the field work, you will measure the geographic location and attributes of a tree (point). In the second part of the lab, you will collect point and line data to georeference a 10 x 10 m sample plot. In Lab 3, we will learn how to visualize your tree and plot data in a Geographic Information System and Google Earth. Through these two exercises you will get a first-hand sense of various factors that introduce error in your measurements.

Study Site

We will be working in a gravel area immediately south of Darwin Hall. Compass declination for 03/05/2010 is +14° 29' changing by -0° 6' /year

Schedule

- Introduce Trimble Juno GPS units, data dictionary and laser rangefinder, and lab exercise (8 am – 9:00 am)
- Part 1: Georeferencing tree points in the field (9:15 am – 10:00 am)
- Part 2: Georeferencing a plot polygon in the field (10:00 am – 11:40 am)

Parts of the Juno SB

The Juno series handheld keypad provides fast, easy access to common actions.

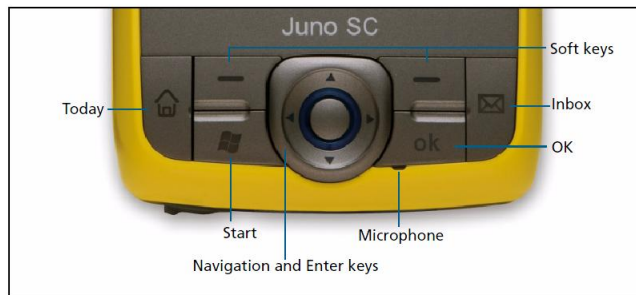


Figure 2.4 Juno series handheld keypad buttons

The function of each key is described below:

Key	Description
Start	Press to display the Windows Mobile Start menu.
OK	Press to select OK or to close an application.
Today	Press to display the Today screen.
Inbox	Press to access the email Inbox.
Navigation keys	Use these keys to navigate around the screen, scroll through menus, or to tab through options on windows and forms. Use the:



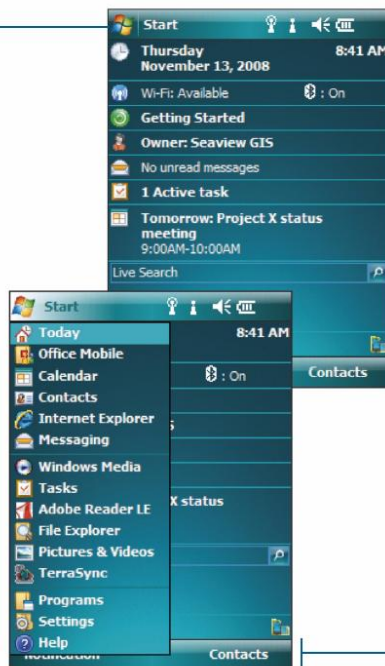
Parts of the Windows Mobile OS screen

Start button

Tap to open the Start menu, where you can access programs and system controls.

Start menu

Tap any item on the menu to open it.



Title bar

Contains status icons for important system functions.

Wireless LAN and Bluetooth icons

Show status of integrated radios. Tap either icon to access the Wireless Manager.

Today screen

Summarizes your appointments, tasks, notes, and emails for the day. Tap any item to open it.

Menu bar

Contains softkeys providing access to applications, menus, and notifications.

Icon	Tap icon to...
	Battery level
	Low battery (10% or less remaining)
	Battery charging/using external power
	Speaker is on
	Speaker is off
	Connected to ActiveSync technology or the Windows Mobile Device Center (WMDC) on a computer
	Connected to a Bluetooth-enabled phone
	Connected to a cellular network
	Disconnected from ActiveSync technology or WMDC
	Disconnected from a Bluetooth-enabled phone
	Disconnected from a cellular network
	Wireless LAN radio is on
	A wireless LAN is detected
	Sending or receiving wireless signals

The Wi-Fi and Bluetooth icons on the *Today* screen show the status of each radio. Tap the icon to access the Wireless Manager and turn on or turn off the radio.

Field Exercise Part 1: Tree location and attributes

In this exercise you will work with a team of students to georeference a tree using 3 different methods.
Survey the same tree with all 3 methods.

- Method 1 - use a GPS receiver placed at the trunk of the tree.
- Method 2 - use GPS control point out in the open and measure distance and azimuth readings with the laser rangefinder and digital compass
- Method 3 – use GPS control point from Method 2, but measure distance and azimuth with a tape measure and field compass, respectively.

The GPS units have been pre-loaded with a data dictionary called “Field Methods Class”. It has point features for trees and plot control points.

The following attributes are available for *Tree* features:


- 1) Survey method (menu)
- 2) Horizontal distance (in meters) – leave blank for Method 1
- 3) Azimuth (in degrees) – leave blank for Method 1
- 4) Species code (4-letters) – if known
- 5) Diameter breast height, DBH (in centimeters)
- 6) Tree height (in meters)
- 7) Group number

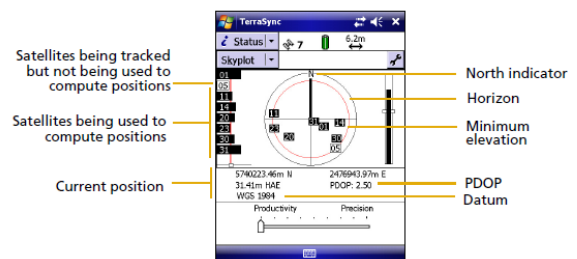
The following attributes are available for *Plot Point* features:

- 1) Plot number
- 2) Point number
- 3) Group number

Method 1: GPS point at tree trunk

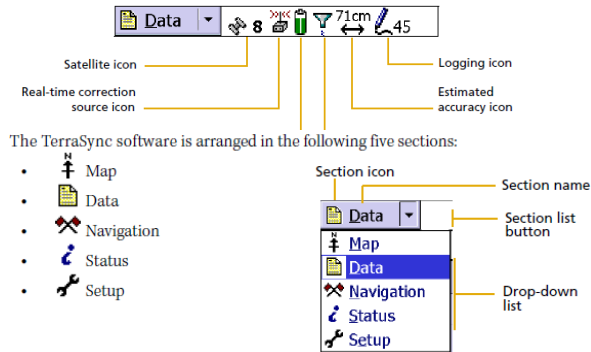
1. Turn on your Juno GPS receiver by holding the power button (upper-left side) a few seconds.

Push the Start button.  Use the stylus or your finger to open the TerraSync application. Go to an open area to allow the unit to find sufficient satellites to update its almanac. You should see a sky plot and a satellite icon in the top center with a blinking number, which indicates the number of satellites being tracked. The unit will retrieve an updated almanac from one of the satellites, and then you should see several satellites appear in the sky plot. The unit may ask to reset the GPS unit. If this happens, use the stylus to click “Ok” and then wait for satellites

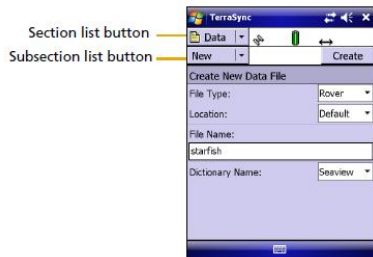


to appear again. Note: if the screen goes blank, try tapping the screen. If this does not wake up the unit, then touch the power button to bring the unit out of sleep mode.

2. Move to a position at the base of your tree's trunk.
3. Get oriented with the TerraSync display.



4. Use the stylus to click the Section Icon in TerraSync (default section is “Status”). Select the Data section. Create a new file if one does not already exist. Give the file a useful name, like your group number and date. Use the “geog315_data_dictionary” option for data dictionary. Click the “Create” button. You will be asked for the antenna height (in meters; 5 ft is 1.5 m). Click OK. Note: If you want to return to an existing file, you would select “Existing File” under the Subsection List button.



5. Select “Tree” from the feature name list. Click the “Create” button. For “Survey method” select “GPS under tree”
6. Allow the GPS unit to collect at least 100 location readings for the tree position. You should see the number of locations collected in the upper-right of the screen. ④ If you do not hear a sound for each location logged, then you can turn on the sound by clicking the volume icon. While you are waiting, enter in the tree’s attributes in the GPS data dictionary form. Enter data for Species and Group number. Click the “OK” button to end collection of data for this tree feature when you have logged sufficient locations.
7. Unless you will go immediately to Methods #2 or #3, close the current file by pressing the Close button, then turn off the GPS receiver by pressing the power button for 3 few seconds.
8. Measure the tree DBH while you are here and write it down in your data form.

Method 2: GPS control point and laser rangefinder distance

1. Move to an open location without canopy cover, yet within sighting distance (<50 m) of your tree.
2. Set up your laser rangefinder staff and bipod legs so that they are level. Turn on the laser rangefinder with the right back button. Turn on the Mapstar digital compass mounted to the laser rangefinder with the bottom-right On button.
3. Measure the tree height with the laser rangefinder.
 - a. Put the laser rangefinder in “HT” (height) mode with the middle right button, and then press the trigger (right back). There should be a “HT” on the left top of the screen and a flashing “HD” in the top middle of the screen.
 - b. Sight the tree trunk through the scope. You should see a red dot in the scope. If not, press the left middle button to increase the intensity of the red dot. When sighting the trunk, avoid low hanging branches and other vegetation in front of the trunk.
 - c. Measure the horizontal distance (HD) to the trunk of your tree by pressing the trigger (right back button). Write this distance down in your data form.
 - d. You should see an “Inc” and flashing down arrow in the top right of the screen. This is to signal to measure a downward inclination angle. Tilt the laser rangefinder down and sight the base of the tree; measure the downward inclination angle by pressing the trigger.
 - e. You should see a flashing up arrow in the top right of the screen. Tilt the laser rangefinder up and sight the top of the tree; measure the upward inclination angle by pressing the trigger.
 - f. Press the trigger one more time to get the tree height (HT) calculation in meters. Write this data down on your data form.
 - g. If you do not get a tree height in meters, then repeat steps b – f.
4. You should see an azimuth angle displayed on the compass screen. Record the angle in your form -- it may dance around a little, so take an average of the readings.
5. Turn off the compass by pressing Select and Hold simultaneously. Turn off the laser rangefinder by simultaneously pressing the front and middle buttons on the left side of the unit.
6. Place a flag or other monument where the bi-pod staff is located and move the laser rangefinder out of position. Turn on your GPS receiver and allow it to find sufficient satellites to update your location. Hold the receiver antenna (top part of unit) over the flag when taking a GPS location.
7. Go back to the TerraSync software and open your data file from the “Data” section, sub-section option “Existing File”. Once the file is open, select the “Update” sub-section item, then “Collect Features”. If you have not yet created a file, then see instructions in Method #1 above. Be sure to use the “geog315_data_dictionary” data dictionary.
8. Select a Tree feature then click “Create”. For “Survey method” select “GPS control - laser”
9. Allow the GPS unit to collect at least 100 locations.
10. While you are waiting, enter in the tree’s full suite of attributes. Enter data for Horizontal Distance, Azimuth, Species, Tree Height, DBH and Group number. Click “OK” when you have logged at least 100 locations.

11. Unless you will go immediately to Methods #1 or #3, close the current file and then turn off the GPS receiver by pressing the power button for 3 seconds.

Method 3: GPS control point and tape measure distance

1. Use the same location with the flag from Method #2. If you are doing Method #3 first, then select a location without canopy cover, yet within sighting distance (<50 m) of your tree. Place a flag in this location.
2. Use a tape measure to measure the straight-line distance to the tree trunk.
3. Use a compass to measure the azimuth angle to the tree trunk.
4. Turn on your GPS receiver and allow it to find sufficient satellites to update your location. Hold the receiver antenna (top part of unit) over the flag when taking a GPS location.
5. Go back to the TerraSync software and open your data file from the "Data" section, sub-section option "Existing File". Once the file is open, select the "Update" sub-section item, then "Collect Features". If you have not yet created a file, then see instructions in Method #1 above. Be sure to use the "geog315_data_dictionary" data dictionary.
6. Select a Tree feature then click "Create". For "Survey method" select "GPS control - laser"
7. Allow the GPS unit to collect at least 100 locations.
8. While you are waiting, enter data for Horizontal Distance, Azimuth, Species, Tree Height, DBH and Group number. Click "OK" when you have logged at least 100 locations.
9. Unless you will go immediately to Methods #1 or #2, close the current file, and then turn off the GPS receiver by pressing the power button for 3 seconds.

Field Exercise Part 2: Plot location and shape

1. Set up a 10 x 10-m field plot with flags at the corners. Ask your instructor for assistance with this step. Note: we will use the hypotenuse of a right triangle to square 2 sides of your square. Using the equation $c^2 = a^2 + b^2$, we have $c = \text{sqrt}(10^2 + 10^2) = 14.14$ m
2. Turn on your GPS receiver, if not already on. Turn both the laser rangefinder and digital compass on.
3. Chose a start point on a corner of your plot. This will be Point #1. Points are then numbered sequentially in a clockwise direction.
4. Position the laser rangefinder staff over the point. Level the laser rangefinder. Have one team member hold the staff with reflector over the next point. Orient the reflector so that it can be sighted from the laser rangefinder. Be sure to hold the staff in a vertical position – not leaning to one side.
5. Put the laser rangefinder in horizontal distance "HD" mode (middle right button). Sight the reflector and press the trigger to take a horizontal distance measurement. Read the azimuth angle from the digital compass. Write these data in the form.
6. Move the laser rangefinder out of position so that you can take a GPS point.
7. Position the GPS antenna over the monument marker of the current point (e.g., a flag).
8. Open your data file from Part 1 by going to the Data section menu, "Existing File" sub-section menu. Once the file is open, select "Collect Features" from the sub-section menu.

9. Select a "Plot Point" feature. Then click "Create".
10. Allow the GPS unit to collect at least 100 location readings for the location.
11. While you are waiting, enter the attributes for Plot number (use "1" for your first plot – you probably will only do one plot), Point number (i.e., 1 for first corner of the plot), Horizontal Distance, Azimuth and Group number.
12. Click "OK" to finish collecting locations for the current position.
13. Move to the next corner of the plot in a clockwise direction.
14. Repeat the steps 4 to 13 for the remaining three corner points.
15. Close the current file, and then turn off the GPS receiver by pressing down the power button for 3 seconds.
16. Turn off the digital compass and laser rangefinder .