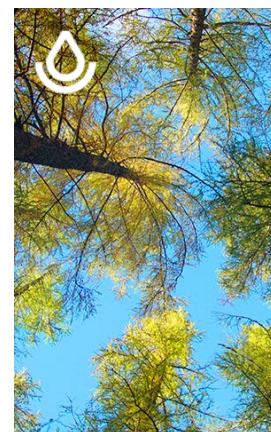




United States Department of Agriculture



Natural
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Use of GPS for NRCS Conservation Planning: Collecting, Managing, and Entering Data

August 15, 2017

Dwain Daniels, GIS Specialist, CNTSC

Gary Hallbauer, NGCE

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nrcs.usda.gov/



Webinar learning objective

How to collect GPS data, maintain data quality, and integrate GPS data into NRCS GIS applications – emphasis on Garmin receivers *

* Not an endorsement – Garmin receivers are used extensively in NRCS





After today's webinar you should be aware of:

- **Pre-collection planning and basic Garmin settings**
- **Data collection best practices; averaging positions**
- **Assessing data collection quality in the field and in the office**
- **Documenting the data collection experience**
- **Integration of Garmin GPS data into NRCS GIS applications**





Garmin GPS / GNSS receivers and NRCS

- **Earliest Garmin receivers go back to perhaps 1998 or 1999 – someone in NRCS may have used it earlier!**
- **First receivers were rudimentary – get a position, see your position on a simple map, navigate to a position, and capture a position**
- **First NRCS wide Garmin receiver was the 2001 USDA SCA Garmin GPS Map 76. Featured 12 channel ‘All in View’ tracking and NDGPS corrections**





Garmins in use in NRCS*

- **GPS Map 76 and Map 76 follow ons**
- **GPS Map 60 and Map 62**
- **eTrex (early models with joystick) and newer models (now at 35 model)**
- **Montana series (now at 680 model)**
- **Oregon series (now at 750 model)**
- **Map 64 series (now at 64sc model)**

* Procurement requests recorded in IAS





If you are using a GPS Map 76 (base) receiver ...

- **Then you are using a receiver that should be replaced:**
 - No longer supported by Garmin (i.e., software updates)
 - Is more difficult to interface with NRCS workstations (has DB9 serial I/O – requires a special I/O card or dock with DB9)
 - The inland NDGPS has been terminated (fall 2016)





About newer Garmin receivers



Newer Garmin receivers can be broken down into two basic categories

- **Receivers with touch screen interface**
 - Montana 680
 - Oregon 650, 750
 - eTrex 25, 35
 - Touch scroll through pre-configured pages of apps such as Mark Waypoint, Camera, etc.
- **Receivers with key interface**
 - Map 64 series
 - eTrex 10 and eTrex 20x
 - Key button scroll through a pre-configured ribbon list of apps





Basic Garmin settings for everyone

Always under Setup page

- **System settings**

- **Satellite system**

- GPS – GPS only
 - GPS + GLONASS (RU)
 - Demo mode

- **WAAS / EGNOS**

- On – Utilizes space based corrections from the FAA WAAS satellite
 - Off – Does not utilize corrections from WAAS





More settings for everyone

Also under Setup page, System settings

- **Interface (data)**
 - Garmin Serial or MTP (BL2G compatible)
 - Spanner (special serial I/O)
 - NMEA text, RTCM
- **AA Battery type (or Battery Type)**
 - Alkaline
 - Lithium or pre-charged lithium
 - NIMH (Nickel Metal Hydride – rechargeable)



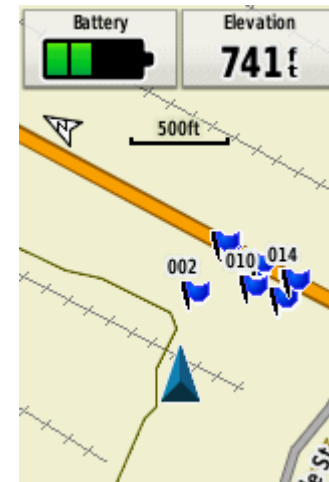
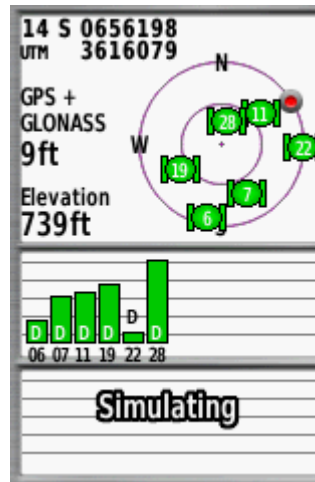
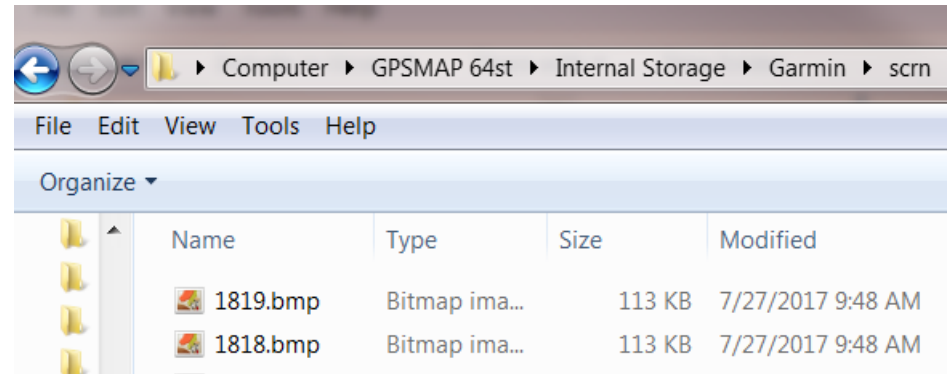


And one more setting for later on

On Main menu – Toggle Screen Capture ‘ON’

- Setup page
 - Display menu page
 - Toggle to ‘ON’

Turns on screen capture
 Capture a screen every time power button is pressed
 Toggle Screen Capture to ‘Off’ when finished
 Captured screen shots are found in the /Garmin/scrn folder





GPS availability planning



Purpose – to obtain knowledge of what satellites are available for your work location – before you go to work

Resources:

- **On the Garmin – none**
- **On the web – available to all:**
 - <http://www.trimble.com/GNSSPlanningOnline/#/Settings>
 - Need IE 11 (Silverlight 5.1.50907.0)
 - won't work with Edge, Chrome, or Windows 10





Starting GNSS Planning Online

Enter the link shown in the previous slide

GNSS Planning opens on the first page - Settings

The screenshot shows the 'GNSS Planning Online' web application interface. The title bar at the top right reads 'Copyright © 2014 Trimble Navigation Ltd. Version: 2.4.6026'. On the left side, there is a vertical menu with buttons for 'Settings', 'Satellite Library', 'Elevation', 'Number of Satellites', 'DOPs', 'Visibility', 'Sky Plot', 'World View', 'Iono Map', and 'Iono Information'. The 'Settings' button is selected. The main content area is titled 'Settings' and contains the following fields and controls:

- Latitude: N 32.6708° (with a 'Pick...' button)
- Longitude: W 97.3328°
- Height: 2m
- Cutoff: 10° (with an 'Obstructions...' button)
- Day: 4/13/2016 (with a calendar icon and a 'Today' button)
- Visible Interval: 8:00 AM (dropdown) | Time Span [hours]: 12 (dropdown)
- Time Zone: (UTC-06:00) Central Time (US & Canada) (dropdown)

An 'Apply' button is located at the bottom right of the settings area. At the bottom of the interface, a summary bar displays the following information:

- Location: N 32.6708°, W 97.3328°, 2m
- Satellite System(s): Glonass
- Local Time: 4/13/2016 8:00 AM - 8:00 PM (UTC-5)
- Cutoff: 10°
- Time Zone: (UTC-06:00) Central Time (US & Canada)



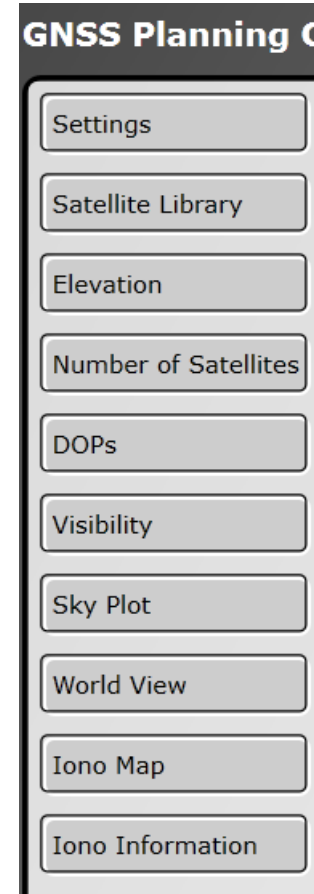


GNSS Planning Online



Most useful tabs (left side)

- **Settings**
- **Library**
- **Number of satellites**
- **DOPs (Dilution of Precisions)**





Choose your location using GNSS Planning

- Click on the 'Pick...' button to the right of the coordinate fields
- Zoom and pan the map to find location
- No image background – best resolution is down to the section or road intersection
- Click Apply

Settings

Latitude: N 32.6708°

Longitude: W 97.3328°

Pick...

Map showing streets: Hartford Ave, W Highland Ave, ST St, NU St.

Your Position

Settings

Latitude: N 36.7176°

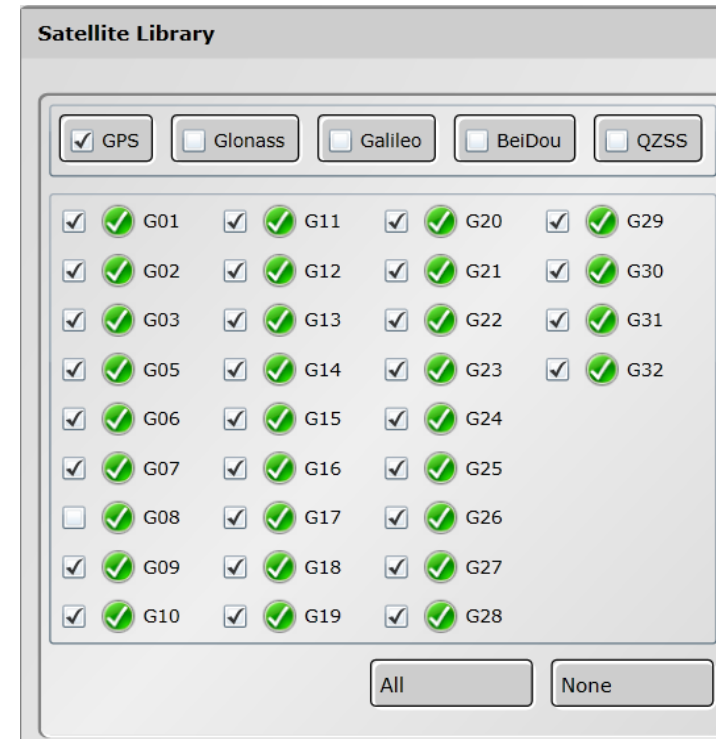
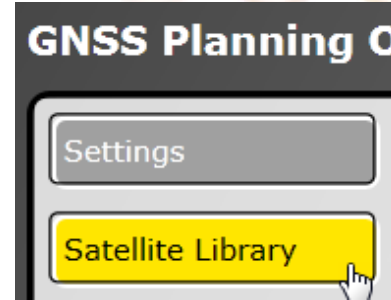
Longitude: W 97.1656°





Use Satellite Library to choose GNSS providers

- Choose from GPS, Glonass, Galileo, Beidou, or QZSS
- Check / uncheck systems to include / exclude from the views
- Check / uncheck satellites within systems to include / exclude from the views
- Click 'All' or 'None' to quick toggle choices





Satellite Availability

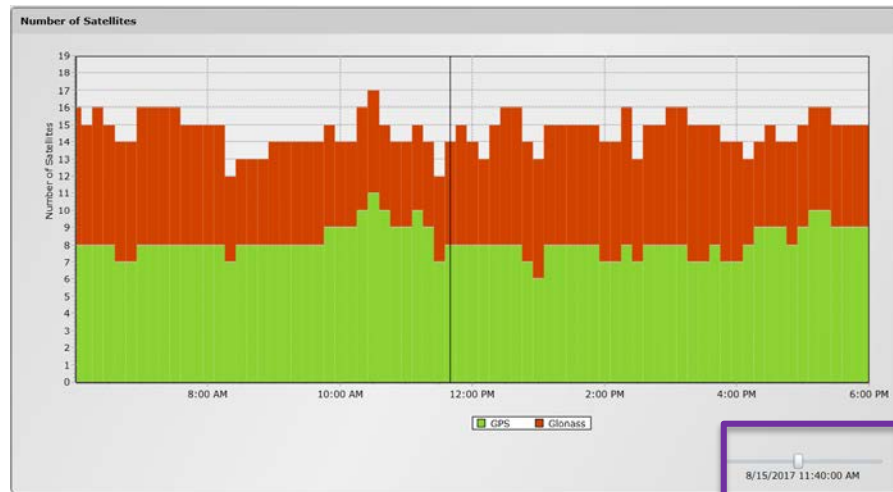


- Be sure all satellites designated with a red 'X' are not checked
- Number of Satellites Tab shows Total GPS satellites and Glonass satellites available

Satellite Library

GPS
 Glonass
 Galileo
 BeiDou
 QZSS

<input checked="" type="checkbox"/> R01	<input checked="" type="checkbox"/> R10	<input checked="" type="checkbox"/> R19
<input checked="" type="checkbox"/> R02	<input checked="" type="checkbox"/> R11	<input checked="" type="checkbox"/> R20
<input checked="" type="checkbox"/> R03	<input checked="" type="checkbox"/> R12	<input checked="" type="checkbox"/> R21
<input checked="" type="checkbox"/> R04	<input checked="" type="checkbox"/> R13	<input checked="" type="checkbox"/> R22
<input checked="" type="checkbox"/> R05	<input type="checkbox"/> R14	<input checked="" type="checkbox"/> R23
<input checked="" type="checkbox"/> R06	<input checked="" type="checkbox"/> R15	<input checked="" type="checkbox"/> R24
<input checked="" type="checkbox"/> R07	<input checked="" type="checkbox"/> R16	
<input checked="" type="checkbox"/> R08	<input checked="" type="checkbox"/> R17	
<input checked="" type="checkbox"/> R09	<input checked="" type="checkbox"/> R18	





DOPs (Dilution of Precision) view

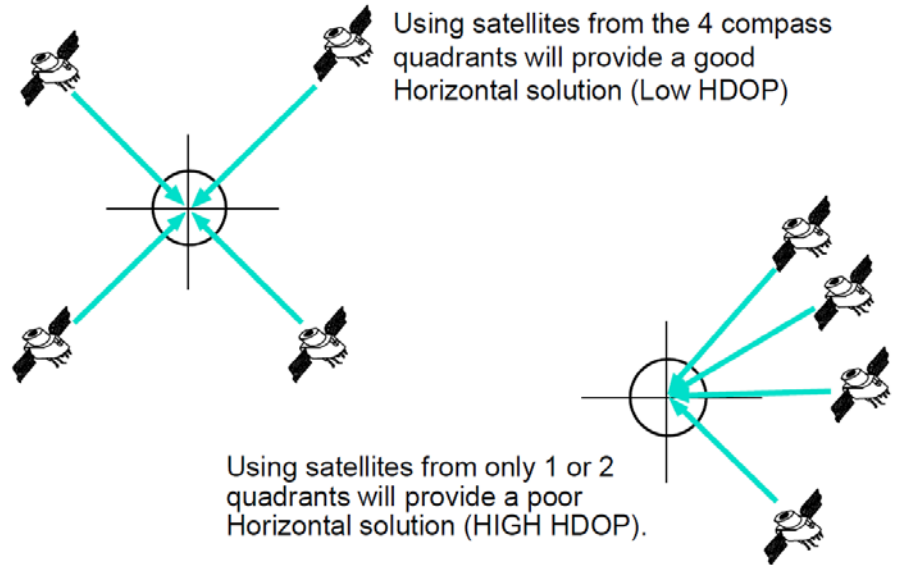


- Use DOPs view to review satellite geometry
- Relationship between DOPs and quality of position:
 - Higher DOPS yield poor positioning
 - Lower DOPS yield better positioning

See also: <https://www.e-education.psu.edu/geog862/node/1771>

Satellite Geometry

HDOP (Horizontal Dilution Of Precision)



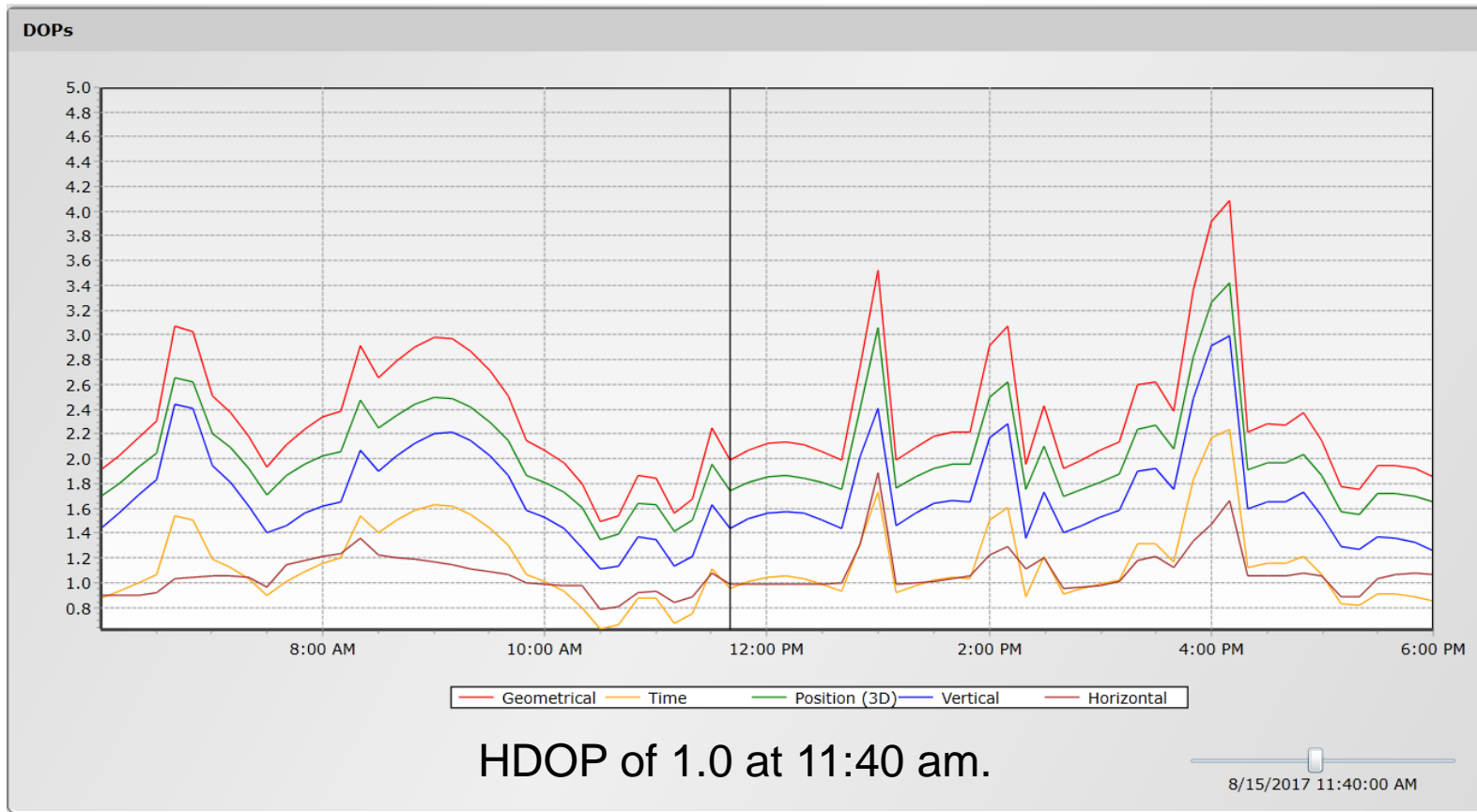
Graphic Source:
<http://www.depts.ttu.edu/geospatial/center/gist4310/documents/lectures/Fall%202012/4310-04%20Principles%20of%20GPS%20Operation.pdf>





Looking at DOPs – key on HDOP*

Horizontal Dilution of Precision estimate over time



* Horizontal Dilution of Precision

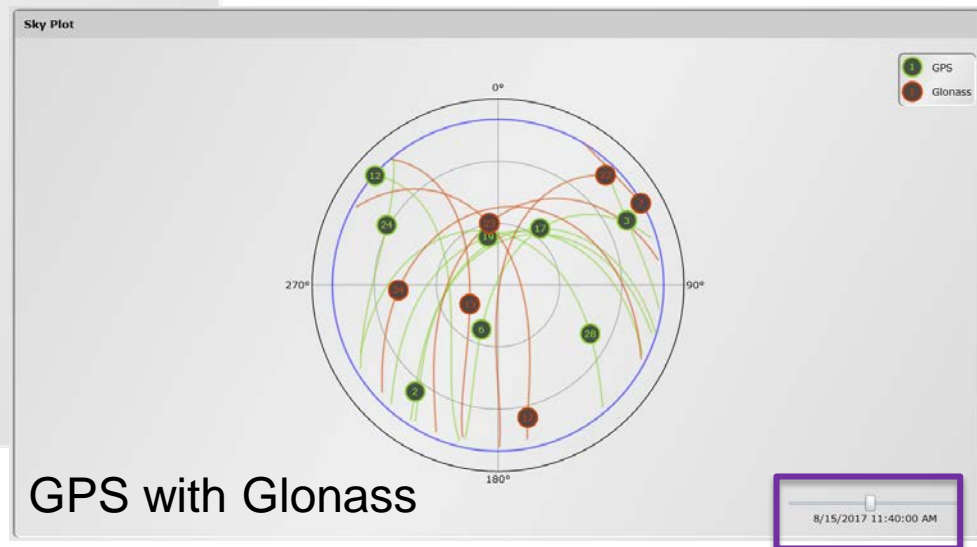
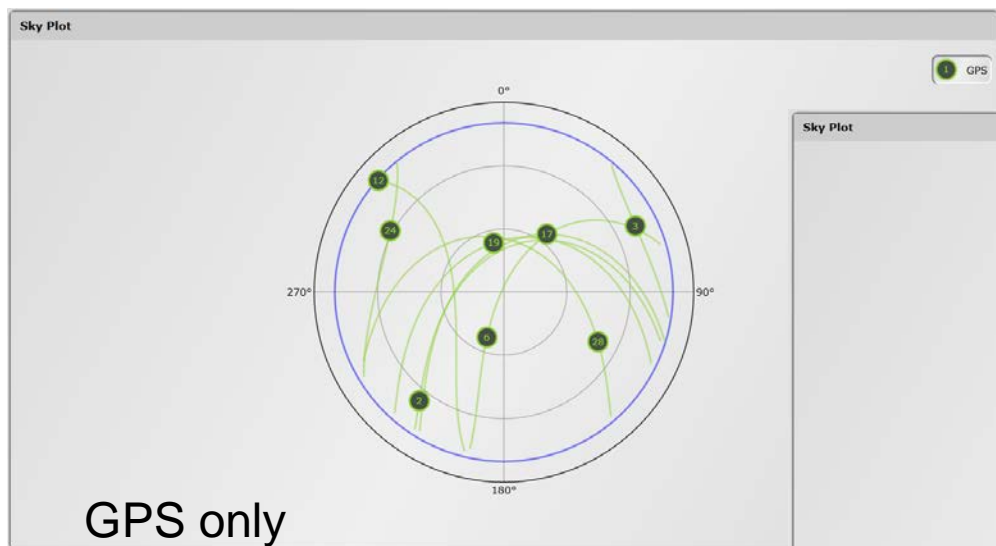




View the Sky Plot



View the Sky Plot to see where satellites are in the sky relative to you (in the center of the plot) and their altitudes above the horizon





Data quality at the job site



- Holding the receiver
- Orientation relative to the constellation
- Orientation relative to FAA WAAS*
- Use of external antennas
- Collection of Tracks and Marking waypoints
- Averaging
- Assessing data quality in the field
- Documenting GPS conditions while in the field

* Wide Area Augmentation System





Holding the receiver



- **What is the best way to hold the receiver?**
 - Garmins should be held at eye level, away from the body, with the antenna pointed to the sky
 - Proper positioning posture
- **Do you need to do this the entire time you are using the receiver?**
 - No, just when you are marking waypoints or tracks
 - Allow several seconds to half a minute for the receiver position to stabilize after movement to this position –before marking waypoints
 - Give the receiver a better view of the sky by reducing body masking





Holding the receiver



Antenna

Antenna





Orientation to the GPS Constellation ✓

Directional orientation with respect to the GPS constellation of satellites:

- **Too many GPS satellites (28 to 32) to matter much**
 - Between 7 and 10 satellites overhead nearly anywhere
- **With GPS + Glonass – really does not matter**
 - Between 7 and 10 GPS overhead
 - Between 5 and 8 Glonass overhead
- **Combined – between 12 and 18 satellites overhead**

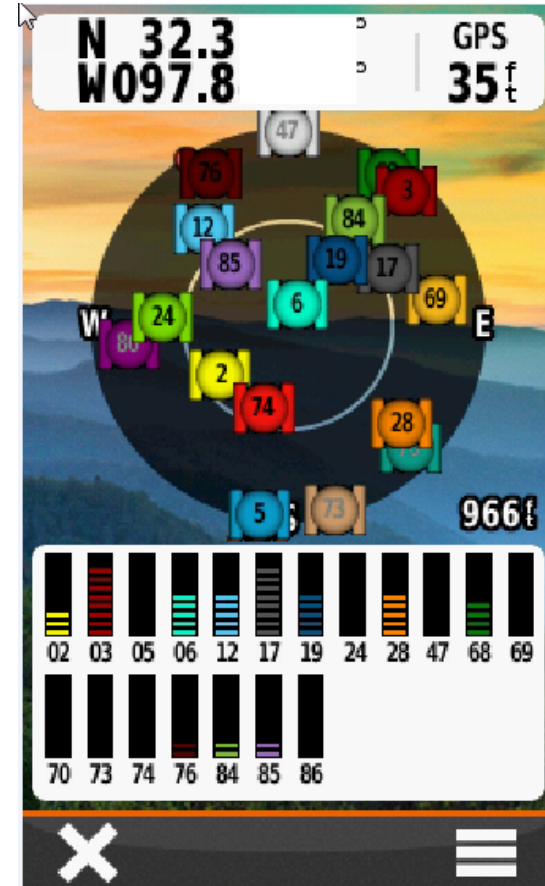
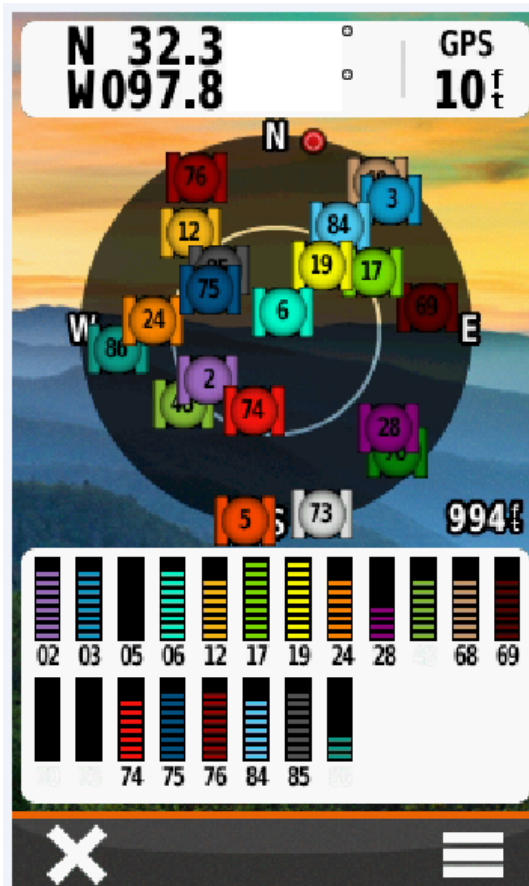




GPS *plus* Glonass – a sky full

It truly does not matter which way you face in open sky.

What is important are the conditions and use of proper technique...



Natural Resources Conservation Service





A little about WAAS *



- **Stabilizes or smooths errors in second by second position computations**
 - Operated by the FAA developed for civil aviation
 - Correction signals transmitted from geosynchronous satellites (~ 24,000 miles away)
 - Near equatorial orbit, constant station
 - Optimized for use > 200' Above Ground Level but corrections available at ground level for much of the U.S.
- **Coverage over North America = Total**
- **Rule of thumb regarding use on the ground – as latitude increases, elevation angle relative to the client receiver decreases – thus WAAS is more readily blocked by terrain and vegetation**



* **Wide Area Augmentation System**



Using external antennas

- **Typical uses**

- Elevate antenna above user (backpack or pole), antenna pole or backpack mount is perpendicular to the ground
- Elevate antenna to access open sky (pole)
- Collect highly stable positions with the antenna plane level (pole with level)
- Collect data over greater time periods (pole with bipod or tripod or long tracks on ground)

- **User must weigh...**

- Desired accuracy of position
- The increased number of pieces of equipment to tote to the field and what that equipment weighs

- **A note – not all Garmins have means to connect an external antenna (e.g. – Oregon 650)**



This antenna has introduced more error than it corrects



Collecting tracks – best practices

- **Track setup**
 - Record method
 - Time
 - 10 second interval if walking
 - 3 second interval if riding (ATV, truck, boat, etc.)
 - Auto Archive – Daily
- **Be in proper positioning posture before starting**
 - Allow a few seconds for the receiver to stabilize before starting a track
- **Maintain steady velocity except ...**
 - Slow down when tracing along a curve – densify points
- **Watch where you are going – not the display**
- **As much art as is science – practice makes perfect**





Marking waypoints

- Use 'data collection posture' and allow the receiver to stabilize for a few seconds
- Hold receiver arms length, about eye level, antenna pointed to sky
- Firmly grasp with one hand, press Mark key (Map 64) or tap the Mark Waypoint App (Oregon 650) with the other hand – the Waypoint page will appear
- The default name of the waypoint is a number
- You can change the waypoint name by toggling the rocker key (Map 64) or tapping in the name field (Oregon 650)



The screenshot shows a handheld GPS device screen with the following information:

- Name:** TEST 001
- Note:** A SIMPLE TEST POINT
- Location:** 14 S 0656311 UTM, 3616027
- Elevation:** 718 f
- Depth:** _____ f
- North Arrow:** N 0 f
- Buttons:** Map, Done

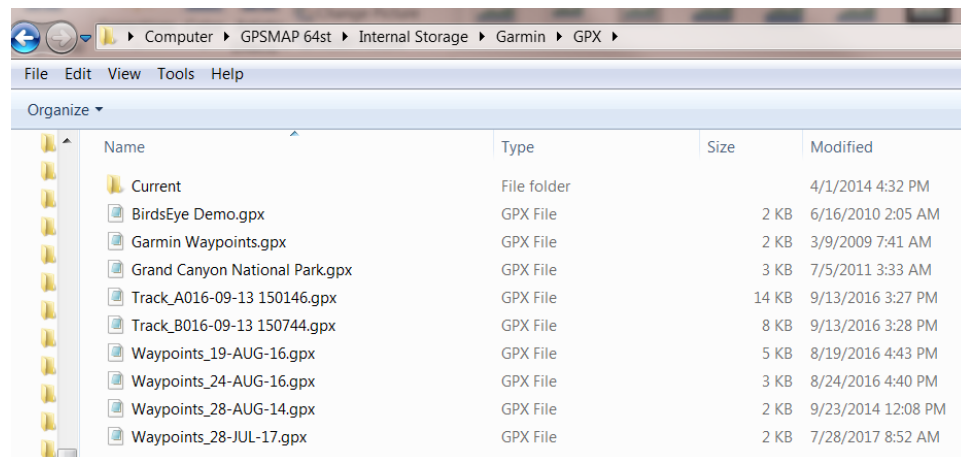


About Garmin Waypoints

- Stored in WGS 84 decimal degree spatial reference system
- Stored as *.GPX formatted files
 - Open GPS format (Topographix) with Garmin enhancements
 - Readable as plain text (Notepad, WordPad)
 - See <http://www.topografix.com/gpx.asp>
- A new GPX file is created daily
- Garmin receiver stores in a file system – much like a thumb drive
- Browse to, copy, then paste to the workstation



```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?><gpx xmlns="http://www.topografix.com/GPX/1/1"
xmlns:gpxx="http://www.garmin.com/xmlschemas/GpxExtensions/v3"
xmlns:wptx1="http://www.garmin.com/xmlschemas/WaypointExtension/v1"
xmlns:gpxtpx="http://www.garmin.com/xmlschemas/TrackPointExtension/v1" creator="GPSMAP 64st"
version="1.1" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.topografix.com/GPX/1/1 http://www.topografix.com/GPX/1/1/gpx.xsd
http://www.garmin.com/xmlschemas/GpxExtensions/v3 http://www8.garmin.com/xmlschemas/GpxExtensionsv3.xsd
http://www.garmin.com/xmlschemas/TrackStatsExtension/v1
http://www8.garmin.com/xmlschemas/TrackStatsExtension.xsd
http://www.garmin.com/xmlschemas/WaypointExtension/v1
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http://www.garmin.com/xmlschemas/TrackPointExtensionv1.xsd"><metadata><link
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28T14:42:23Z</time><name>TEST 001</name><cmt>A SIMPLE TEST POINT</cmt><sym>Flag, Blue</sym></wpt></gpx>
```



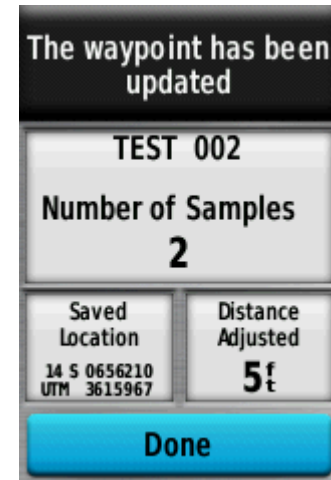
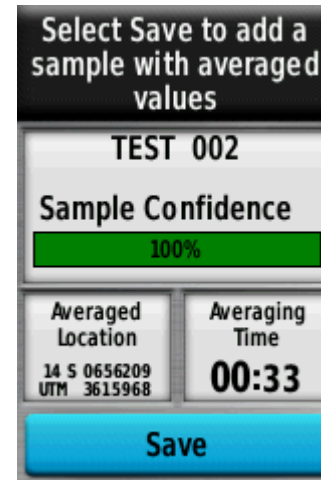
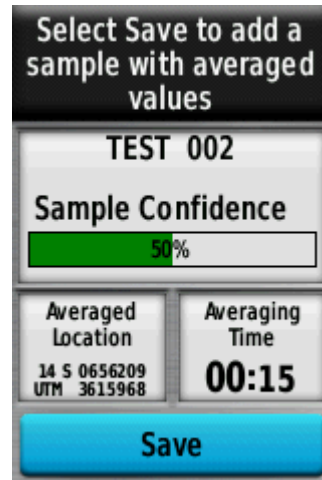
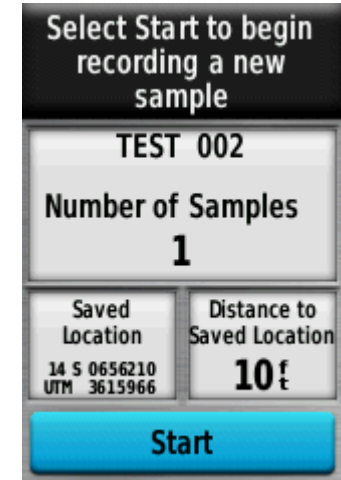
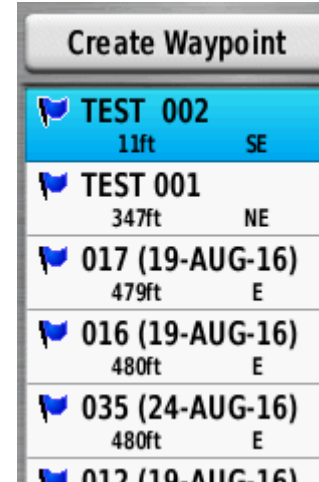
Name	Type	Size	Modified
Current	File folder		4/1/2014 4:32 PM
BirdsEye Demo.gpx	GPX File	2 KB	6/16/2010 2:05 AM
Garmin Waypoints.gpx	GPX File	2 KB	3/9/2009 7:41 AM
Grand Canyon National Park.gpx	GPX File	3 KB	7/5/2011 3:33 AM
Track_A016-09-13 150146.gpx	GPX File	14 KB	9/13/2016 3:27 PM
Track_B016-09-13 150744.gpx	GPX File	8 KB	9/13/2016 3:28 PM
Waypoints_19-AUG-16.gpx	GPX File	5 KB	8/19/2016 4:43 PM
Waypoints_24-AUG-16.gpx	GPX File	3 KB	8/24/2016 4:40 PM
Waypoints_28-AUG-14.gpx	GPX File	2 KB	9/23/2014 12:08 PM
Waypoints_28-JUL-17.gpx	GPX File	2 KB	7/28/2017 8:52 AM





Averaging waypoints – newer Garmins

- Toggle or tap on **Waypoint Averaging** on the **Garmin**
- **Select the waypoint to average – then Start**
- **Tap ‘Save’ to save**





Averaging best practices

- **Be in proper positioning posture before starting**
- **Don't move – introduces error**
 - Maintain same distance from body, eye level
 - Maintain facing same direction
 - If you move – redo waypoint and average again
- **Use the Garmin algorithm**
 - Full sample confidence of 100% achieved in about 30 seconds in open sky
- **If you go less than 100% - document how long (sec) you average**
- **Using more than 30 seconds in open sky yields diminishing returns; in challenging environments – may not help all that much – think Glonass instead**
- **Garmin advises: Wait 90 minutes before averaging (Who does that really?)**
 - Wait a few seconds for the receiver to stabilize before starting average

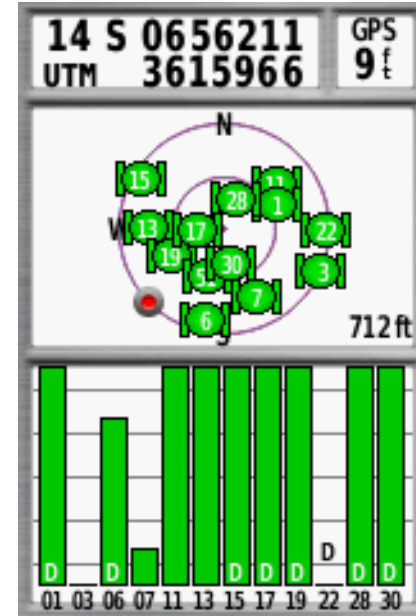
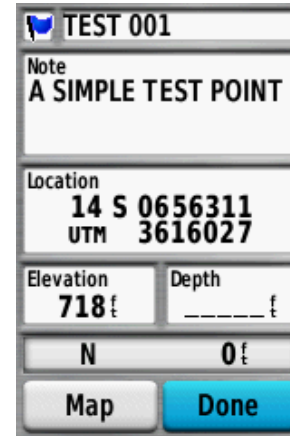




Documenting GPS conditions while in the field

In field documentation

- In a field notebook
- In notes within a feature (waypoints only)
- Using screen shots
 - Screen shot at beginning of work session
 - Screen shot after collection of a waypoint or track – correlate these by the time stamps
 - Screenshot at the end of a work session
 - Store screenshots in project or customer or work site folder as ‘graphical metadata’



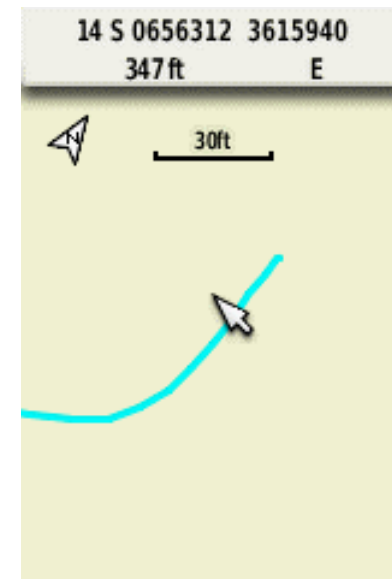
- Relative geometry
- Quality of positioning
- Signal strength





Assessing data quality in the field

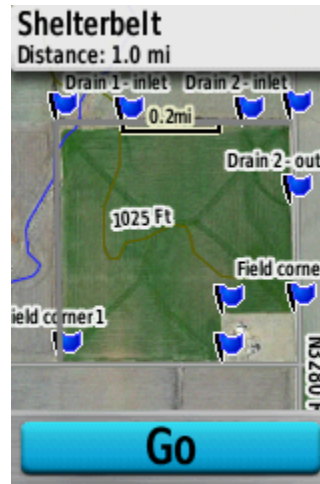
- **View the feature against a map or image background on the Garmin**
 - 24K topo map
 - Birdseye™ image data (many new receivers come with a 1 year Birdseye subscription)
 - How does the feature collected compare to it's surroundings?
 - If a point – does the point location on the receiver map have the same relationship to other points on the ground?
 - If a track – does the track match a visible feature? Are there spurious features along the track (i.e. zingers)?





Compare data quality using imagery

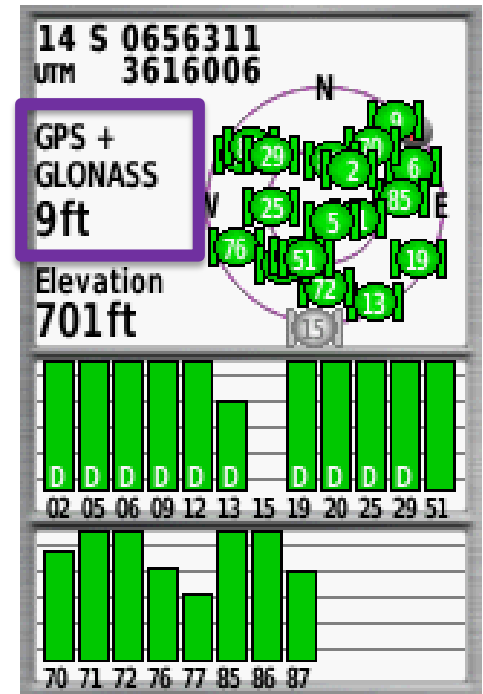
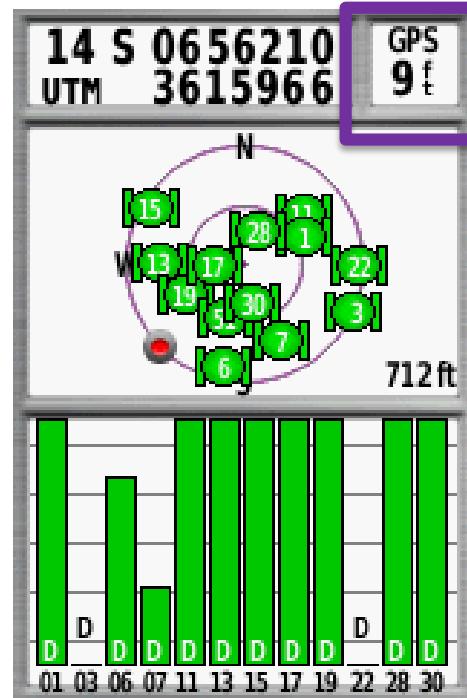
- Newer Garmins come with 1 yr. Birdseye™ imagery subscription
- Download imagery using BaseCamp – then transfer to receiver
- Turn on imagery display in Map settings
- Compare in the field





Garmin estimated accuracy

- Appears in the upper right corner of the satellite page on all receivers when operated as GPS only
- Left side – just below the coordinates – on receivers operated using Glonass



Estimated accuracy on Garmin receiver





Comparing data to NGS survey marks

- Answers ‘How accurate am I today?’
- Retrieve reference ‘Data Sheets’
<https://www.ngs.noaa.gov/datasheets/>
- Select data format (Datasheets or GIS Shapefiles)
- Select retrieval method
 - Interactive map
 - Search (by county, point ID, point name)

The NGS Data Sheet

```

PROGRAM = datasheet95, VERSION = 8.12.2
1 National Geodetic Survey, Retrieval Date = JULY 31, 2017
HV9260 *****
HV9260 CBN - This is a Cooperative Base Network Control Station.
HV9260 DESIGNATION - ADM HULL
HV9260 PID - HV9260
HV9260 STATE/COUNTY- MD/MONTGOMERY
HV9260 COUNTRY - US
HV9260 USGS QUAD - WASHINGTON WEST (1983)
HV9260
HV9260 *CURRENT SURVEY CONTROL
HV9260
HV9260 NAD 83(2011) POSITION- 38 59 35.22102(N) 077 01 52.29302(W) ADJUSTED
HV9260* NAD 83(2011) ELLIP HT- 131.197 (meters) (06/27/12) ADJUSTED
HV9260* NAD 83(2011) EPOCH - 2010.00
HV9260* NAVD 88 ORTHO HEIGHT - 163.2 (meters) 535. (feet) GPS OBS
HV9260
HV9260 NAVD 88 orthometric height was determined with geoid model GEOID93
HV9260 GEOID HEIGHT - -32.330 (meters) GEOID93
HV9260 GEOID HEIGHT - -31.966 (meters) GEOID12B
HV9260 NAD 83(2011) X - 1,114,003.508 (meters) COMP
HV9260 NAD 83(2011) Y - -4,837,292.649 (meters) COMP
HV9260 NAD 83(2011) Z - 3,991,805.710 (meters) COMP
HV9260 LAPLACE CORR - -2.59 (seconds) DEFLEC12B
HV9260
HV9260 Network accuracy estimates per FGDC Geospatial Positioning Accuracy
HV9260 Standards:
HV9260 FGDC (95% conf, cm) Standard deviation (cm) CorrNE
HV9260 Horiz Ellip SD_N SD_E SD_h (unitless)
HV9260 -----
HV9260 NETWORK 0.76 2.86 0.34 0.27 1.46 -0.00451432
HV9260 -----
HV9260 Click here for local accuracies and other accuracy information.
HV9260
HV9260
HV9260 The horizontal coordinates were established by GPS observations
HV9260 and adjusted by the National Geodetic Survey in June 2012.
HV9260
HV9260 NAD 83(2011) refers to NAD 83 coordinates where the reference frame has
HV9260 been affixed to the stable North American tectonic plate. See
HV9260 www.ngs.noaa.gov/web/surveys/NA2011 for more information.
HV9260
HV9260 The horizontal coordinates are valid at the epoch date displayed above
HV9260 which is a decimal equivalence of Year/Month/Day.
HV9260
HV9260 The orthometric height was determined by GPS observations and a

```





NGS Interactive search

- Use interactive map to browse to work location
- Place 'X' point in the middle of the work site
- Nearest NGS listed marks will appear
- Tune the map layers to show GPS positioned NGS benchmarks
- Click on 'Find Marks'; Marks will appear on the map – if a mark is within a good distance (subjective) – click on the mark, then click on the Datasheet link

View Map View List

Help
Map Layers

Horizontal

★ CORS
 ▲ GPS Sites
 △ Classical Horizontal

Vertical

● Vertical Control
 ○ Approximate Heights

Find Marks Clear Marks



Find nearest mark and retrieve DS

Select the mark...

National Geodetic Survey Data Explorer
National Geodetic Survey

View Map | View List

Help | Map Layers

Horizontal

- CORS
- GPS Sites
- Classical Horizontal

Vertical

- Vertical Control
- Approximate Heights

Find Marks | Clear Marks

Location radius: 5 Miles
Mark Center

Go To Location

PID : GH0234

Name : M 131
Elev Source : ADJUSTED
Elev Order : 2
Pos Source : ADJUSTED
Pos Order : None
Ortho Ht : 303.933
Ellip Ht : 275.143

Datasheet

Show/Hide Legend

Map data ©2017 Google Imagery ©2017, DigitalGlobe, Landsat / Copernicus, Texas Orthometry Program, U.S. Geological Survey, USDA Farm Service Agency | Terms of Use | Report a map error
Website Owner: National Geodetic Survey / Last modified by ngs.infocenter Thursday, 15-Dec-2016 11:10:32 EST

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The NGS Data Sheet

See file [dsdata.pdf](#) for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.12.2
1 National Geodetic Survey, Retrieval Date = JULY 31, 2017
GH0234 *****
GH0234 CBN - This is a Cooperative Base Network Control Station.
GH0234 DESIGNATION - M 131
GH0234 PID - GH0234
GH0234 STATE/COUNTY- OK/KAY
GH0234 COUNTRY - US
GH0234 USGS QUAD - BLACKWELL (1968)
GH0234
GH0234 *CURRENT SURVEY CONTROL
GH0234
GH0234* NAD 83(2011) POSITION- 36 45 11.98095(N) 097 15 16.82235(W) ADJUSTED
GH0234* NAD 83(2011) ELLIP HT- 275.143 (meters) (06/27/12) ADJUSTED
GH0234* NAD 83(2011) EPOCH - 2010.00
GH0234* NAVD 88 ORTHO HEIGHT - 303.933 (meters) 997.15 (feet) ADJUSTED
GH0234
GH0234 GEOID HEIGHT - -28.779 (meters) GEOID12B
GH0234 NAD 83(2011) X - -646,128.759 (meters) COMP
GH0234 NAD 83(2011) Y - -5,075,680.362 (meters) COMP
GH0234 NAD 83(2011) Z - 3,795,660.153 (meters) COMP
GH0234 LAPLACE CORR - -2.27 (seconds) DEFLEC12B
GH0234 DYNAMIC HEIGHT - 303.672 (meters) 996.30 (feet) COMP
GH0234 MODELED GRAVITY - 979,766.7 (mgal) NAVD 88
GH0234
GH0234 VERT ORDER - SECOND CLASS 0
GH0234
GH0234 Network accuracy estimates per FGDC Geospatial Positioning Accuracy
GH0234 Standards:
GH0234 FGDC (95% conf, cm) Standard deviation (cm) CorrNE
GH0234 Horiz Ellip SD_N SD_E SD_h (unitless)
GH0234 NETWORK 0.69 1.53 0.32 0.22 0.78 -0.09310229
GH0234 -----
```





Take the datasheet info to the field

- Record the coordinates from the Datasheet or print the datasheet
- Once in the field – compare GPS performance before or after a collection – by standing on the NGS mark
- Capture a waypoint or two or three over a period of a couple of minutes
- Document with screen shots
- Best practice – enter the mark as a waypoint, set the Garmin to navigate to the point, stand on the point, and record the distance to the point – before or after a collection session





Decision time ...



- If the data on the receiver matches features on the ground – accept and move on...
- If the data (or some of the data) do not match features on the ground – redo those parts that do not match.
- How does the receiver performance compare to surveyed reference marks?
- If there are still issues – time to reassess:
 - GPS conditions (# SATS, masking, canopy, SNR)
 - Feature collection technique (*proper posture?*)
 - Mode of collection
 - If waypoints – try averaging
 - If tracks – try collecting waypoints instead

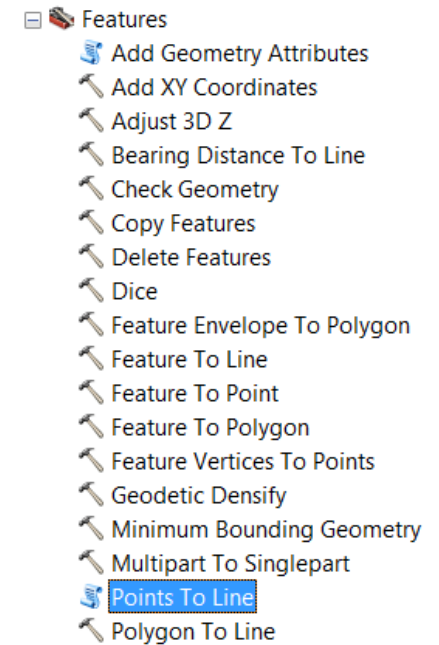
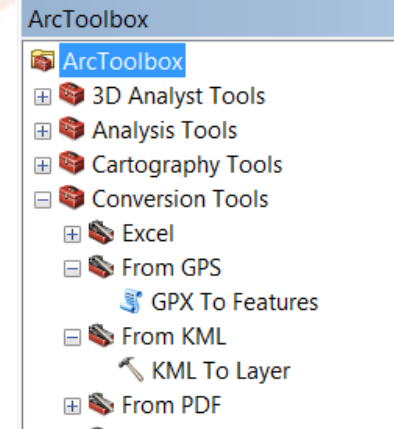




Integration of GPS data.

GPX to Features tool – Converts GPX files into ArcGIS features

- Provide name and location for input GPX file
- Provide name and location for output feature class
 - Shape file or,
 - Geodatabase feature class
- Imports tracks as points
 - Use Data Management Tools > Features > Points to Line to make into lines

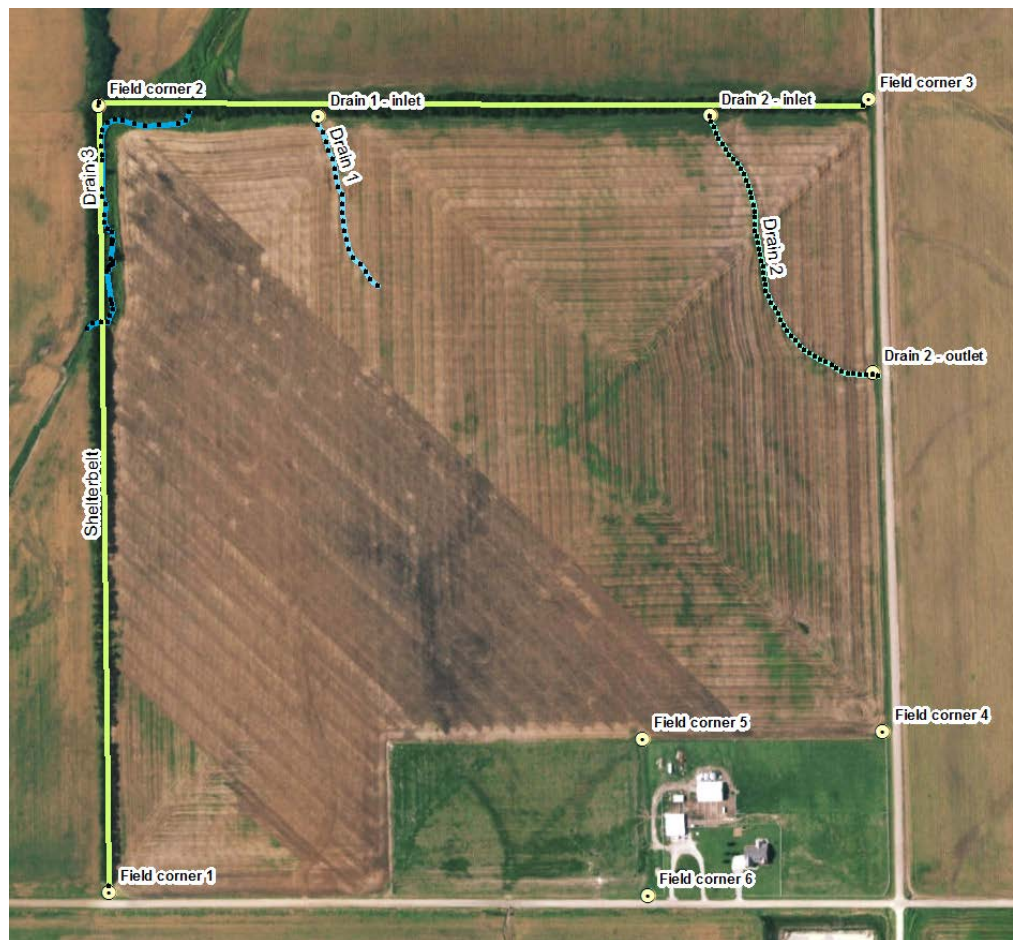




ArcMap GPX import results



Tracks symbolized and labeled



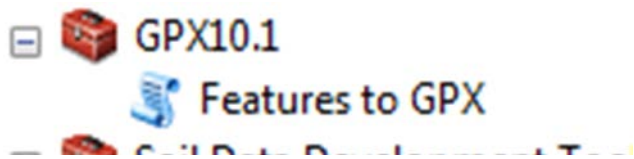
Track points
and points to
lines shown





View Feature Class on GPS Device

- Simple process.
- Good if Users need to navigate to existing features using current labels.



Add a Field to Attribute Table

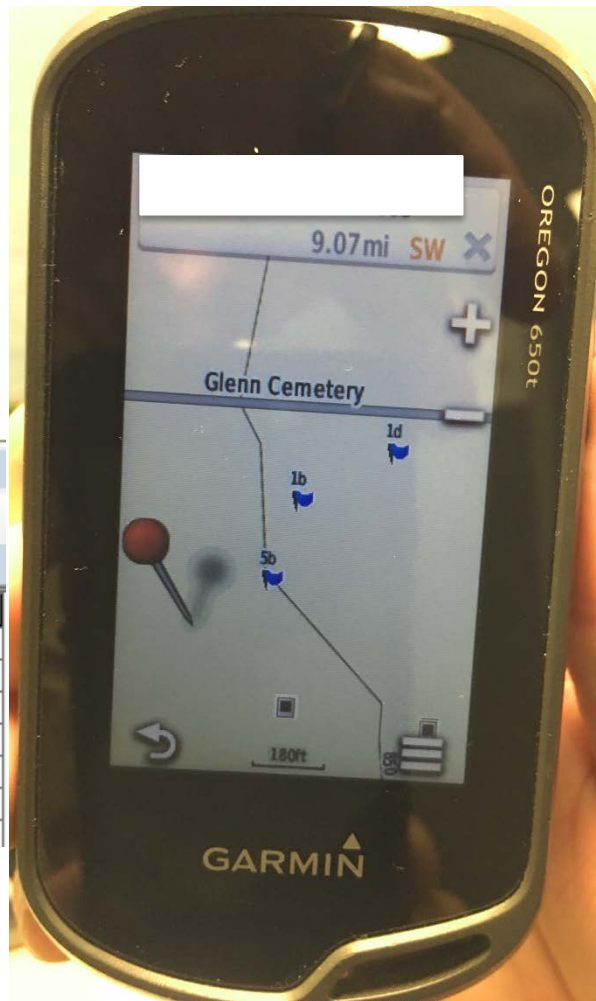
FID	Shape *	OBJECTID	CID	NAME
0	Point	1	1	1d
1	Point	2	1	1c
2	Point	3	1	1a
3	Point	4	1	1e
4	Point	5	1	1f
5	Point	6	1	1b
6	Point	7	2	2a

```

<wpt lat=
<ele>0</ele>
<time> </time>
<name>1d</name>
<desc> </desc>
</wpt>
<wpt lat="32. ... 3730 ... lon="
<ele>0</ele>
<time> </time>
<name>1c</name>
<desc> </desc>
</wpt>
<wpt lat=": ... lon=":-:
<ele>0</ele>
<time> </time>
<name>1a</name>
<desc> </desc>
</wpt>
<wpt lat=": ... lon=":-:
<ele>0</ele>
<time> </time>
<name>1e</name>

```

Name field visible in Garmin Map



Garmin Data integration recommendations

For Garmin GPX import

- Use the ArcMap tool 'GPX to Features'
- Convert track points to lines
- Label and symbolize for the plan document

For ArcMap feature export to Garmin receivers

- Use ArcMap Features to GPX tool.
- Converts points to Waypoints, lines to Tracks
- Open using Track Manager or Waypoint Manager & View Map.

NGCE does have an effort to automate these tools and reduce the number of applications to step through.





Review

- **Replace Map 76 receivers and maintain software on other models – reinvest if necessary.**
- **You can use GPS/GNSS planning online applications to view the positioning environment before and after a field visit.**
- **Use proper positioning technique to achieve best results when capturing waypoints and tracks.**
- **Use WAAS corrections and averaging to increase positioning accuracy (within limits).**
- **Use best practices for averaging to achieve best results when averaging waypoints.**
- **Document GPS information and conditions using notes or screenshots as needed.**
- **Assess data quality in the field and redo if possible, review data quality in the office and edit if needed**
- **Import Garmin data using ArcMap GPX to Features; export using ArcMap Features to GPX.**





Questions?



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