



# Avoiding the Common GPS Pitfalls:

## “GPS Best Practices”

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# Equipment Setup

- **Current OS and GPS Firmware installed.**
- **Current Date and Time on the data collector.**
- **Data collector is fully charged.**
- **Software Installed, compatible and working?**



# Equipment Setup

- **Turn off WiFi and Bluetooth to conserve battery.**
- **Automobile charger and serial clip for charging.**
- **External battery pack or spare battery**



# Current 2008 WM6.1 Geo OS and GPS FW

*Start/Settings/System/System Information*



## System Information

Serial Number: 5036401179  
OS Revision: 5.3.1 (Build 1045)  
Nov 11 2009  
20:21:48  
CPU Type: Marvell,  
ARM920T-PXA27x  
520 MHz  
RAM: 128MB  
(23MB reserved)  
Flash Disk: 1024MB  
(664MB free)  
GPS Receiver: GeoXH  
GPS Firmware: v2.11, 9 Jan 2009  
Bluetooth Address: 70 f3 95 90 f8 0c  
WLAN Address: Unknown





# Current Geo 6000 WM6.5 OS and GPS FW

*Start/Settings/System/System Information/GNSS*



## GNSS Information

Receiver ..... GeoXH  
Channels ..... 220  
Frequency Bands ..... L1/L2/G1/G2  
Constellations ..... GPS + GLONASS  
Firmware ..... v3.01.4, 24 Aug 2011



# Know your hardware Specs





# Antenna Height: Internal or External

ArcPad 10:24

### GPS Preferences

Antenna Height  m

Geoid Separation  m

Use Map Units for Height Units

Height Units

Use Height In Datum Transform

Quality GPS Height Datum

ok X

TerraSync 10:39

### Confirm Antenna Height

Height:

Type:

Measure To:

OK Cancel

R041422A

Dictionary Name:

GPS Workshop



# Best Practices: In the field

- **Horizontal/Vertical and In the Field/Post Processed accuracy settings.**
- **Post Processing Distance from Base.**
- **Estimated Accuracy icon on the status bar (click on it to display) TerraSync and GPS Correct.**

The screenshot shows a status bar with a 'Data' dropdown menu, a signal strength indicator (6), a battery icon, and an accuracy icon labeled '5in'. A red arrow points to the '5in' icon. Below the status bar, a yellow box displays the following accuracy information:

Estimated accuracy in the field
Horizontal: 4.6ft
Vertical: 3.5ft
Estimated accuracy after postprocessing
Horizontal: 5in
Vertical: 7in



# Best Practices: In the field

- 1 second logging – “Averaging”

ArcPad - Untitled

### GPS Preferences

Enable Averaging

Number of positions to average :

Points

Vertices

Streaming :

Position Interval

Distance Interval  ft

GPS Capture Quality

ok

# Open conditions: Good for Sub-Foot to Decimeter Horizontal



# Multipath

## Occasionally multipath errors occur

- **GPS Signal is being delayed/disrupted.**  
“Chain Link Fences, Automobiles, Metal & Glass buildings and bodies of water.”
- **Estimated error may not always include multipath.**
- **Multipath tends to cancel out when you collect GPS measurements while moving.**
- **External Antenna’s have better multipath rejection (Stealth technology).**



# Collect good GPS measurements between features

- **Collect good quality data before and after you collect your feature (maintain GPS/Initialization - lock).**
- **In theory, you don't have to collect too many positions in a point feature, once the accuracy indicator readings are good enough.**
- **But if you collect for about 20 to 30 seconds, you increase the chance of acquiring more satellites or cancelling out short-term multipath errors.**
- **If the accuracy indicator readings are poor, you should log more positions or cancel and start again.**



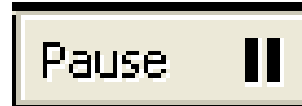
# Log Now or Later

- **Log Now** – start a feature and simultaneously start collecting GPS position.
- **Log Later** – start a feature, enter attributes and start collecting GPS positions later. Use this for lines and areas too.





# Pause GPS logging before entering attribute information:



- **Allows you to concentrate on positioning:**
  - **Holding the antenna over the location to be measured.**
  - **Holding the antenna horizontal with a good view of the sky.**
- **It is not easy to do this while concentrating on entering attribute information.**

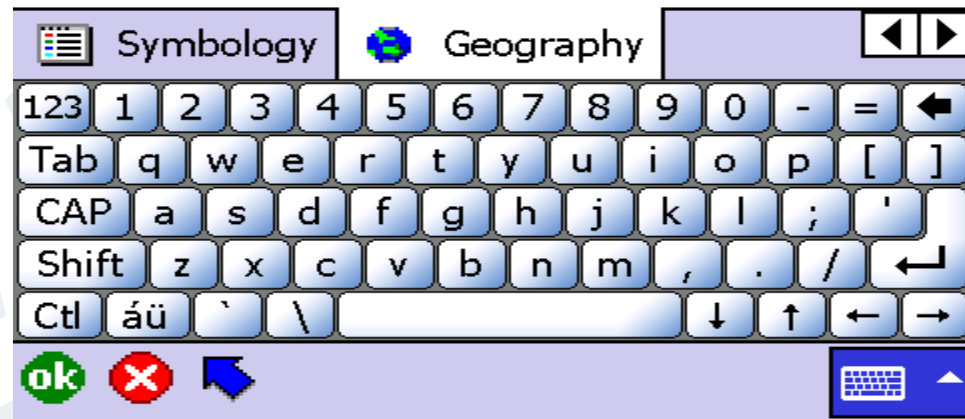


# Log GPS again if not satisfied with accuracy



## Points

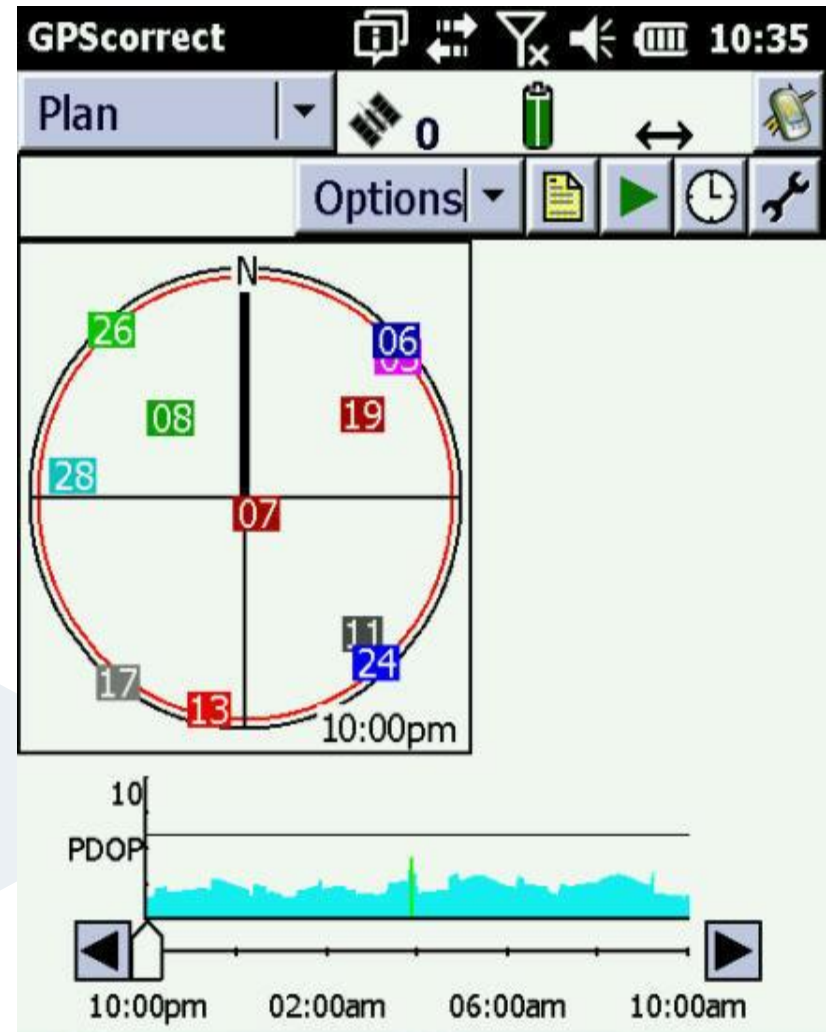
	X	0 00 00.0000 E
	Y	0 00 00.0000 N
	Z	0
	M	
	30	





# In Field Planning

- **Planning Sky plot**
  - **View “DOPS” and future satellite constellation, including trajectories and trails.**
- **Use time in the field more efficiently**
- **Increase productivity**

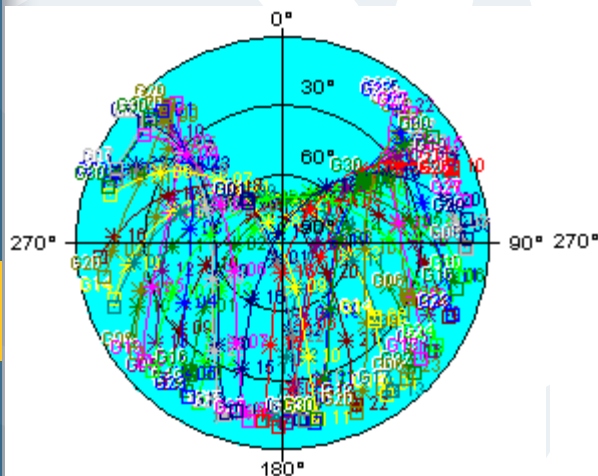




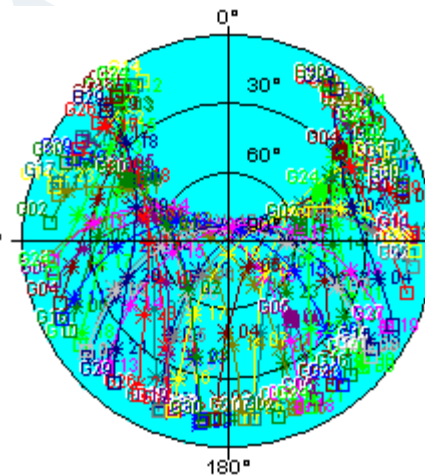
# Best Practices: In the field

- Avoid blocking satellites with your own body use an external antenna.
- The majority of satellites are between you and the equator (GPS).
- Be aware of surrounding Obstacles.

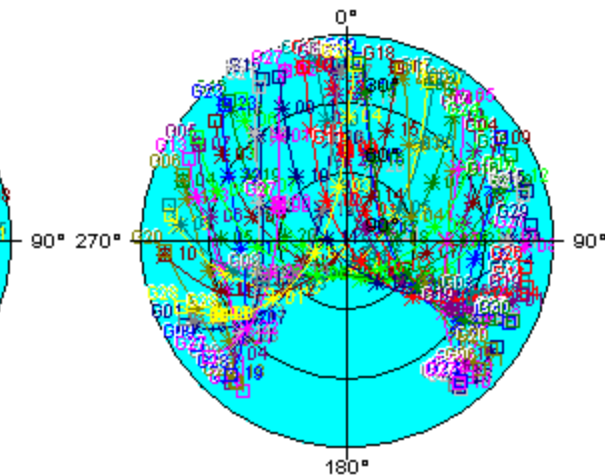
Denver, USA



Frankfurt, Germany



Christchurch, New Zealand

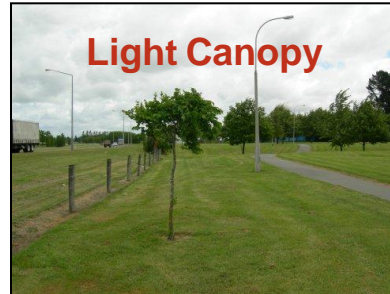


# Be Mindful of Buildings or other obstructions

- Wait for stable GPS Initialization and Carrier lock.
- Use offset measurements or Laser Rangefinder.



# Trees and canopy



- Use an external antenna on a pole for greater GPS gain and stability.
- Wait for a stable lock before entering canopy environments.
- Collect data before and after entering canopy environments (carrier data that is free of cycle slips).
- Use offset measurements or Laser Rangefinder.



# GPS and Glonass (GNSS)

- **GPS – Global Positioning System**
- **Glonass – Global Navigation Satellite System**
- **GNSS – Global Navigation Satellite System**
  - **multiple GPS Satellite Systems: Europe and China are building their own now.**
  - **If you are using a GPS unit that can track and record **GPS** and **Glonass** you can increase your productivity tougher GNSS conditions.**
  - **Use a RTN/VRS.**
  - **Post Process against a GNSS base station!!!!**





# Cellular VRS Connection


- **Must have cellular DATA service in your work area:**
  - Verizon, AT&T, US Cellular, T-Mobile or Sprint etc.
  - Data Plan is needed (differs from a voice plan)
- **A simple cell phone with a data plan is best: avoid Blackberries and I-Phones**
- **Make sure “Tethering” or “PAM” is enabled for Bluetooth**
- **Carry external battery pack to charge phone or bring a spare battery. Car charger for GPS Unit and phone.**
- **A Bluetooth cell phone uses less battery than a MiFi, Droid WiFi etc.**





# Post Processing Base Files vs. Base Provider?

Differential Correction Wizard



**Base Data**

Base Provider Search  
COOP\_CORS, Seiler - Franklin Office Select...

Folder Search  
C:\Users\jriester\Documents\GPS Projects\Default\Bas Select...

Browse  
Browse...

**Reference Position**

Use reference position from base files

Use reference position from base provider  
COOP\_CORS, Seiler - Franklin Office Select...

Confirm base data and position before processing

**Datum of the Base Station Antenna**

**Datum that Trimble has Transformed the Base Station to: "ITRF00"**

< Back   Next >   Cancel   Help



# Post Processing GNSS Data

Select Base Provider

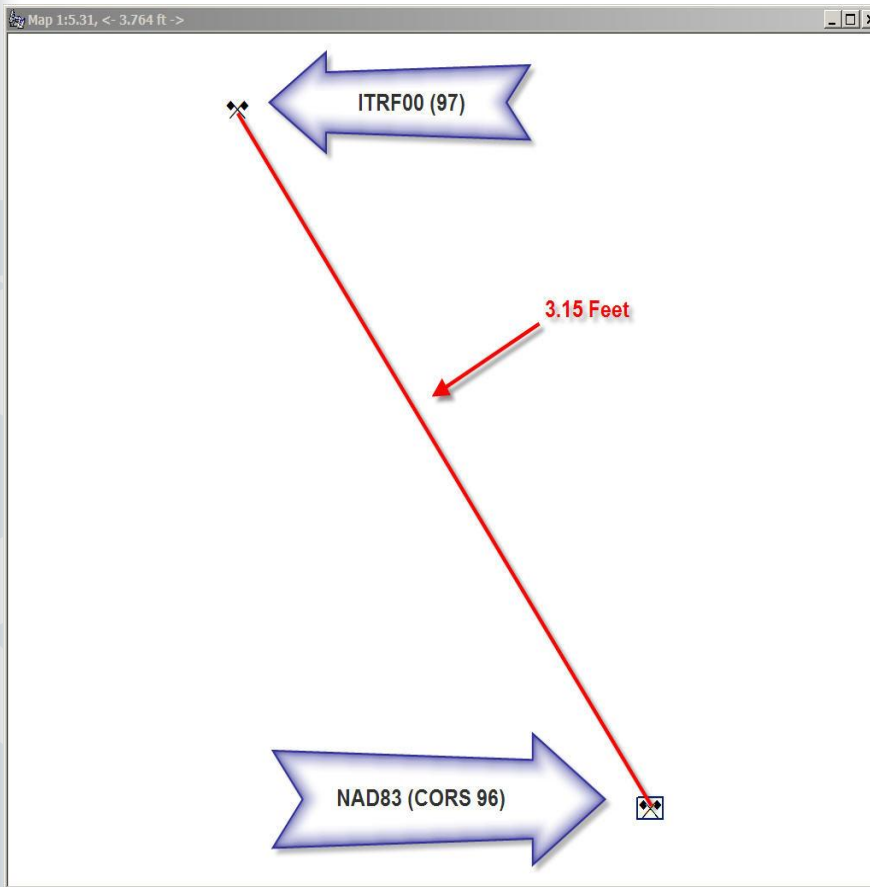
Provider	L2	G	Distance	Integrity Index
CORS, ROCK RIVER COOP (RRW1), ILLINOIS	x		33 mi	94.19
UNAVCO, Iowa County, Wisconsin (jfw)*	x		48 mi	?
CORS, MCHENRY COOP (KA15), ILLINOIS	x		62 mi	?
CORS, MCHENRY COOP (KA15), ILLINOIS	x		62 mi	?
Seiler - R.A. Smith National, Inc.	x		63 mi	?
COOP_CORS, Seiler - Franklin Office	x	x	68 mi	?
CORS, SEILER FRWI COOP (SIWI), WISCONSIN	x		68 mi	93.40

Show Base Providers of Type:

Base Provider



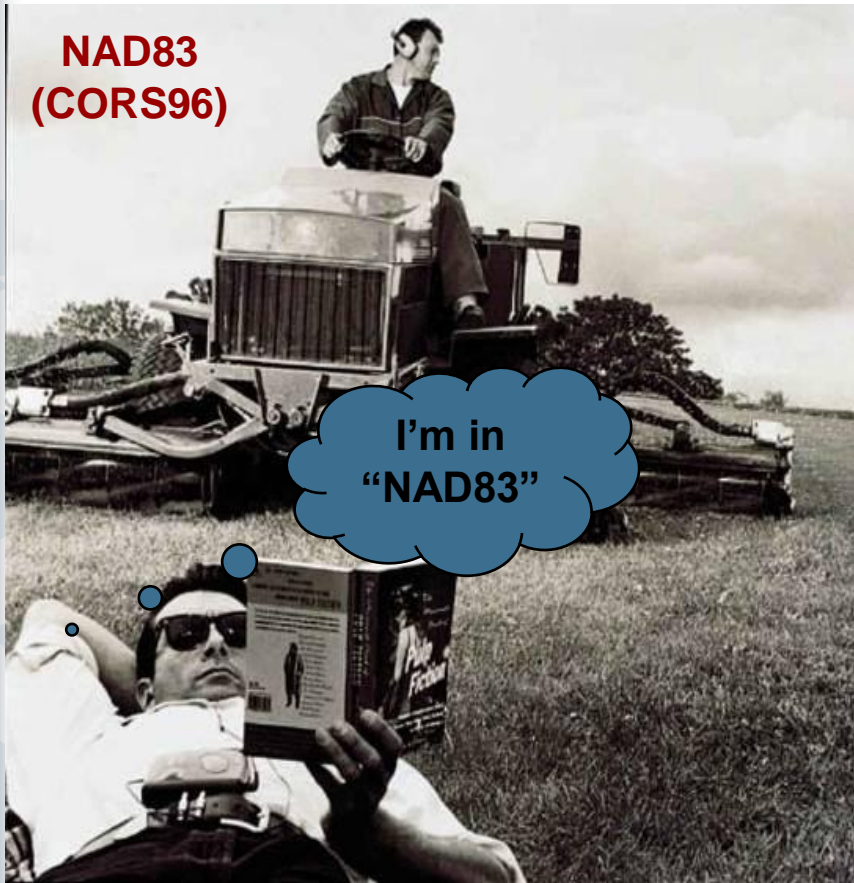
# Datum Shift



- Know your correction source.
- **WAAS and Beacon are different!**  
**WGS84 vs. CORS96**
- Confirm your base station if post-processing.
- Find one base station that works and stick with it for post processing.
- Compare certified known control monument(s) before starting a project



# Datum's



- Choosing the wrong datum can greatly shift your data!
- NAD27 to NAD83 could mean 50 feet or more Horizontal.
- "NAD83" has different versions:
  - NAD83 (86)
  - NAD83 (91)
  - NAD83 (97)
  - NAD83 (CORS 96)
  - NAD83 (CORS 96A Epoch 2010/2011?) coming soon.



# **BLOGS and Support Websites**

- **<http://seilermapsupport.wordpress.com/>**
  - **[www.trimble.com/support](http://www.trimble.com/support)**
  - **<http://www.ngs.noaa.gov/>**
  - **<http://arcpadteam.blogspot.com/>**
- **<http://resources.arcgis.com/gallery/video/arcpad>**



# Questions?

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